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Training Technologies Pilot Study: Nonresident Computer Based Training Effectiveness Evaluation

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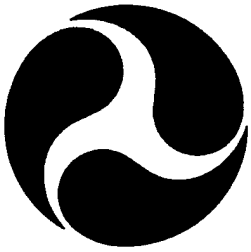

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16. Abstract (maximum 200 words)

A pilot study was performed by the U.S. Coast Guard Research and Development Center (R&DC) to explore the potential benefits of using state-of-the-industry technologies as a "travel-free" alternative to instructor-led training performed at a resident training center (schoolhouse environment). This report presents the results of the effectiveness evaluation and duty station implementation analysis, which were performed as a part of the pilot study. A third part of the pilot study, the cost comparison analysis, is presented in a separate report.

The effectiveness evaluation compared instructor-led training delivered at a resident training center, with nonresident, computer-based training (CBT) delivered to students at their duty stations. The effectiveness evaluation found that nonresident CBT, delivered to students at their duty station, is equivalent in training effectiveness to the instructor-led resident version of the same course, delivered at the duty station.

The purpose of the duty station implementation analysis was to identify problems associated with nonresident training delivered at the duty station, and recommend solutions (e.g., procedures, infrastructure changes) that are feasible within the Coast Guard organization. This effort was accomplished by visiting several of the duty stations where personnel participated in the pilot study. During these visits, a team consisting of R&DC staff and an R&DC contractor interviewed personnel who were either directly involved in overseeing the training related to the pilot study, or were part of the command chain at the operational unit (e.g., Commanding Officer).

The recommendation of this report is for the Coast Guard to move forward with implementation of nonresident training delivered to personnel at their duty stations, but issues related to the successful implementation of nonresident training at the duty station must be addressed.

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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	* 2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
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oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (EXACT)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly).

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (WEIGHT)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	0.125	cups	c
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
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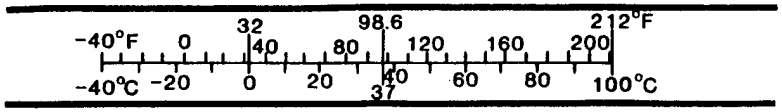

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EXECUTIVE SUMMARY

INTRODUCTION

The United States Coast Guard (USCG) Research and Development Center (R&DC) is investigating the application of advanced training technology to improve the cost-effectiveness of training. A major part of this program is the evaluation of Computer-Based Training (CBT), as an alternative to traditional training approaches. The *Training Technologies Pilot Study* project has embarked on a study to evaluate the cost/effectiveness of nonresident CBT, in comparison with instructor-led resident training at a USCG training center. The one-week, instructor-led AN/WSC-3(v)7 UHF Transceiver Maintenance course, offered at the USCG Training Center, Petaluma, California (TRACEN Petaluma), was selected as the baseline for this evaluation. In addition, a duty station implementation analysis was performed to identify issues and recommend solutions based on the experiences of the various USCG units (duty stations) whose members participated in the nonresident CBT portion of the study. Many of the issues identified, and the recommendations proposed, would be common to other nonresident media considerations (e.g., interactive video-teletraining (IVT), correspondence). Therefore, references to nonresident training are defined as the entire range of media that may be employed by the USCG to deliver training to personnel at their duty stations.

METHODOLOGY

A CBT version of the resident AN/WSC-3 course was developed for the study by an independent contractor. The training effectiveness evaluation was based on an experiment comparing three training strategies, using three groups of students from units around the country:

- AN/WSC-3 CBT course conducted at duty stations (CBT Duty Station Group) - The CBT course was shipped to each student's duty station, prepackaged on a multimedia laptop computer. A facilitator at each duty station coordinated the training. The students were tested at TRACEN Petaluma after course completion.

- AN/WSC-3 CBT course conducted at TRACEN Petaluma (CBT Remote Group) - These students received the same CBT course as the duty station students, but in the school environment at TRACEN Petaluma. They were tested at TRACEN Petaluma after course completion.

- Traditional, instructor-led AN/WSC-3 resident course conducted at TRACEN Petaluma (Resident Group) - These students received the traditional one-week course. They were tested at TRACEN Petaluma after course completion.

Training effectiveness was evaluated at TRACEN Petaluma, on the basis of: 1) pre- and post-training knowledge tests; 2) operation and maintenance performance measured by evaluators during troubleshooting of malfunctioning AN/WSC-3(v)7 UHF transceivers; and 3) students' reactions given in modified C-School Critiques. Training time was also assessed.

Staff at about half of the participating duty stations were interviewed after completion of all training and testing activities. The purpose was to identify issues and potential problems

associated with the implementation of training at duty stations, including suggestions for dealing with them.

CONCLUSIONS

The computer-based training course for AN/WSC-3 operation and maintenance was successfully conducted at 13 USCG duty stations in different parts of the United States. This training was equal in effectiveness to training conducted at a USCG training center, including both the CBT course and the traditional instructor-led resident course. Nonresident operation and maintenance training conducted at USCG duty stations, therefore, can be as effective as courses conducted at training centers.

Substantially reduced training time is a potentially major benefit of CBT, in comparison with instructor-led resident training. The nonresident AN/WSC-3 CBT course required an average 70% less training time than the equivalent instructor-led resident course. Similar reductions in training time were achieved with the CBT course conducted at the training center.

The students, commanders and other staff interviewed at the participating duty stations generally support the implementation of nonresident training (e.g., CBT, IVT). They feel that nonresident training can succeed in the USCG, and will be a major benefit to duty stations. Nonresident training is viewed by duty station staff as:

- Having less adverse impact than resident training on the overall team's ability to perform its mission; resulting in greater staff availability; minimizing unit disruptions; easing unit staffing problems; and resulting in increased training efficiency.
- Assisting their general unit training requirements.
- A partial solution to problems associated with minimal-crewed vessels.
- Helping the pipeline training problem.

Duty station staff believe existing obstacles must be overcome with careful organization, and development and execution of the training process. Important issues identified were:

- The training process and procedures must provide the unit flexibility to schedule and conduct training in accordance with the unit's particular situation. This includes a strong training management organizational structure at the duty station, and at other levels in the USCG.
- Sufficient time should be provided daily, during normal work hours, for the conduct of training. Training should be scheduled like any other work task.
- Interruptions must not be allowed while students are actively engaged in training, except for real emergencies.
- The area and room in which a student is training must have an environment conducive to learning, such as minimizing distractions.
- Effective approaches must be developed to achieve hands-on training and student certification as part of the duty station training process.

RECOMMENDATIONS

The USCG should proceed with the implementation of nonresident CBT at duty stations. This will require selection of courses to convert, conversion of the courses, and establishment of an effective training process at duty stations.

The many issues associated with large-scale implementation of nonresident CBT, and other nonresident media delivery methods, are expected to require some re-organization of the USCG's infrastructure, affecting both operations and training. These should include organizational changes for managing resident and nonresident training, and the necessary checks-and-balances to assure that effective training is regularly achieved at duty stations.

Special emphasis should be placed on assuring that the initial courses converted to a nonresident mode (e.g., CBT, IVT) are as effective as the resident courses they replace.

Many suggestions for establishment of an effective training process at duty stations were received during the interviews, and are addressed in the report. Examples are:

- Strong overt command support for duty station training, at all levels across the USCG, must be given and demonstrated.
- A student-help hotline is recommended to provide all duty station students with immediate access to a subject matter expert.
- A section should be added to the USCG's PCO/PXO Course, addressing how to establish and conduct an effective training process at duty stations.
- Software tools should be developed for the duty station, to support training management, monitoring and oversight of student training, and administrative coordination.

An internal USCG marketing effort should be established, to inform personnel at all levels about nonresident training (e.g., CBT, IVT).

Guidelines should be developed for all levels of the USCG (e.g., students, command chain) addressing how to develop and conduct an effective training process.

A centralized quality assurance process should be developed as a check-and-balance, to assure that an adequate level of training effectiveness is developed and maintained at all duty stations. This process should also be responsible for maintaining, modifying and upgrading courses as necessary.

A detailed transition plan is required to guide the implementation of nonresident training (e.g., CBT, IVT) across the USCG. This plan will require research to resolve many of the identified issues affecting the establishment of an effective training process at duty stations.

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1 INTRODUCTION

The United States Coast Guard (USCG) conducts many training courses to develop and improve the proficiency of its personnel. Although a variety of training methods and media are used, most of the training uses traditional instructor-led methods conducted at training centers. The rapid growth of modern training technology, much of which is computer-based, provides opportunities for effectiveness and efficiency improvements in the delivery of training across the USCG. This project evaluated the potential effectiveness of nonresident computer-based training (CBT), conducted at USCG duty stations. In addition, a duty station implementation analysis was performed to identify issues and recommend solutions based on the experiences of the operational units (duty stations) whose members participated in the nonresident CBT portion of the study. Many of the issues identified, and the recommendations proposed, would be common to other nonresident media considerations (e.g., interactive video-teletraining (IVT)). Therefore, references to nonresident training are defined as the entire range of media that may be employed by the USCG to deliver training to personnel at their duty stations. This document reports the methodology and findings of the research.

Note, this project is one of several phases accomplished as part of the *Training Technologies Pilot Study*. A separate cost analysis of nonresident CBT, in comparison with traditional resident training, was performed as another part of the *Training Technologies Pilot Study* (Kingsley, Cummings, and Hammell, 1998).

1.1 BACKGROUND

1.1.1 Advanced Training Technology

The past forty years have seen tremendous advancements in training technology, and its economical availability (Office of Technology Assessment, 1988; Reisman and Carr, 1991). CBT, in various forms, has been in use for well over 30 years. Its relatively high cost in comparison with traditional training methods, however, has limited the use of CBT until more recent years. CBT has characteristics that can be used to enhance the training process, such as its ease in providing for student interactivity, presentation of graphics and animation, and allowance for self-paced instruction. For example, student interactivity (Campbell, 1988), visual media presentation (Shriver, Shriver and Bunderson, 1984; Shulman, Vogel and Reilly, 1986), and self-paced instruction (Hamel and Clark, 1986) have been shown to facilitate the learning of complex tasks. These types of student visualization and interactive processes require substantial computing power. Until recently, all but the most basic CBT training applications required expensive workstations to achieve the media characteristics necessary to support complex training. In addition, the development of the sophisticated training software and the operation of networked CBT systems were also expensive. Consequently, computers were primarily used in training to drive sophisticated simulators, where their high cost could be justified in support of operational team training. In essence, the simulator's development and operational costs were justified in comparison with the cost, and safety, of operating ships and other equipment. Although educators were well aware of the potential of CBT in the classroom, computers were seldom used in this context until recent years.

Computer-based training, which began in the late 1950's (Reisman et. al., 1991), began infiltrating traditional training environments in the early to mid 1980's, ostensibly as interactive video disk (Wright, 1993), and then later as multimedia. Studies have touted the potential benefits of the various forms of CBT. For example, studies have generally found a reduction in training time from CBT in comparison with the traditional training, with an average of 50% reduction estimated (Miller, 1990). This has been attributed to several factors, including self-paced training, personalized instruction (e.g., beginner-level instruction versus advanced-level instruction) student interactivity and consistent training.

The increasing capabilities and lowering cost of the microcomputer, together with the evolving development of sophisticated software tools to construct and manage CBT media, have substantially reduced the cost of CBT courses. Today, CBT can be cost-competitive with traditional training methods. The cost trade-off involves hardware, software development, training content development, instructor and student time, laboratory hardware and operation, course distribution and management, and student travel.

Today, CBT may be delivered in several forms, such as interactive video disk and interactive courseware (ICW). The multimedia CBT trend is to make a variety of computer-based media available on a low-cost desktop or laptop personal computer, such that a training program can use the best mix of media to deliver the course.

1.1.2 Coast Guard Training Issues

Traditional, instructor-led training methods used at Coast Guard Training Centers are effective, having been evolved over many years. However, two factors suggest the need to explore changes to these traditional methods. Those factors are the continual tightening of annual budgets which requires a constant vigilance for ways of reducing costs, and the current training system is somewhat inflexible in meeting the range of training needs of USCG units. The availability of effective modern training technologies presents a potential opportunity to reduce training costs, and increase the responsiveness of USCG training programs, while maintaining training effectiveness. In essence, this is a technology push.

Each instructor-led resident course has a limit on the number of students who can attend a class; often resulting in a demand for student positions that exceeds the space available. Consequently, USCG units have a limit on the number of personnel who can be trained in a particular specialty (i.e., training quotas), and are unable to get their training needs met at the appropriate time. Furthermore, resident training center courses are usually scheduled at fixed times during the year. These times may not be convenient to the work demands of particular units, with the result that personnel may not receive the desired training even if they can obtain a student position for the course. Finally, personnel in many cases must travel great distances from their units to attend a resident course. In some cases these classes may be several weeks in length. During the training period, attending personnel would not be available to assist their units should an emergency occur. The inherent inflexibility of the current training system places a burden on USCG units and personnel.

Costs to operate and staff a resident training center are substantial. The potential exists, through the use of CBT and other modern training technologies (e.g., interactive video-teletraining), to

reduce training costs by shifting a portion of training from the resident training centers to the USCG units. This may be achievable with a substantial net cost savings, through the application of modern training technologies. This shift of training locale, coupled with the use of modern training technologies, would provide additional benefits to USCG units, such as vastly increased training flexibility.

1.2 PROBLEM AND OBJECTIVE

As a result of the training issues stated, the U.S. Coast Guard Headquarters' Office of Training and Performance Consulting (G-WTT) tasked the R&DC to perform a study of modern training technologies. This study is referred to as the "Training Technologies Pilot Study." The goal of the study was to determine the potential impact of using state-of-the-industry (modern) training technologies as alternative methods for meeting USCG training needs. A major advantage of CBT is to have a substantial amount of training done at duty stations, therefore the effectiveness of nonresident training becomes an important issue. The problem to be addressed was, can nonresident training at duty stations be as effective as instructor-led training at resident training centers. This issue does not necessarily pertain to all resident training, but rather to the training of skills and knowledge that should be responsive to CBT methods.

The objective of this study was to determine the feasibility of conducting training at duty stations, in lieu of training centers. During an earlier phase of the project the USCG selected the operation and maintenance course for the AN/WSC-3(v)7 UHF transceiver as the context of the empirical evaluation. This one-week course addressed skills and knowledge that appeared conducive to the CBT medium and delivery method. The AN/WSC-3 resident course was developed into CBT form for training at duty stations. The objective of this study, more specifically therefore, was to empirically determine if the nonresident AN/WSC-3 CBT course, to be conducted at duty stations, could be as effective as the instructor-led resident course taught at a Coast Guard training center. An outgrowth of this investigation would be the demonstration of nonresident training at duty stations.

A second objective was to identify important issues and problems associated with the implementation of nonresident training at duty stations. This was accomplished by interviewing unit staff where personnel took the nonresident CBT version of the AN/WSC-3 course at their duty station (unit). Based on the results of those interviews, recommended solutions are presented in this report.

1.3 REPORT ORGANIZATION

The main body of the report is organized into the following sections:

2. Methodology
3. Training Effectiveness Results
4. Training Effectiveness Discussion
5. Duty Station Implementation Analysis Findings
6. Conclusions
7. Recommendations

2 METHODOLOGY

The methodology used during the study addressed the 1) training effectiveness evaluation, and 2) analysis of implementation issues. The training effectiveness evaluation addressed the design and conduct of an experiment to evaluate the training effectiveness of a nonresident AN/WSC-3 CBT course conducted at duty stations, in comparison with traditional instructor-led courses conducted at a resident training center. The analysis of implementation issues addressed the conduct of interviews at a subset of the duty stations participating in the nonresident CBT, to identify issues and problems associated with duty station training, and to recommend actions for dealing with them.

2.1 TRAINING EFFECTIVENESS EVALUATION METHODOLOGY

2.1.1 Overview

The evaluation of nonresident training focused on a computer-based training course conducted at USCG duty stations across the country, in place of a traditional instructor-led course conducted at a resident training center. After careful consideration of several factors, the AN/WSC(v)7 UHF Transceiver Maintenance Course (AN/WSC-3 course) was selected by the USCG to serve as the comparative baseline for the study. Following course selection, a CBT version of the selected course was developed to be equivalent to the instructor-led resident course. Delivery of the CBT version of the course would be on multimedia laptop computers at duty stations.

A formal experiment was conducted to compare the effectiveness of three training approaches, with three different groups of students:

1. The AN/WSC-3 CBT course conducted at the students' respective duty stations. This group is called the CBT Duty Station Group (DS).
2. The AN/WSC-3 CBT course conducted at the USCG Training Center in Petaluma, California (TRACEN Petaluma). This group is called the CBT Remote Group (RM).
3. The traditional instructor-led AN/WSC-3 resident course conducted at TRACEN Petaluma. This group is called the Resident Group (RS).

The CBT course was delivered to the CBT Duty Station Group students prepackaged on a multimedia laptop computer, shipped to each student's duty station. A facilitator, designated by the commanding officer at each duty station, was charged with overseeing the conduct of the training, and the data collected at the duty station. Upon completion of the CBT course, the students were sent on Temporarily Assigned Duty (TAD) to TRACEN Petaluma to complete the remaining tasks in the experiment.

The CBT Remote Group students received the prepackaged CBT course in the schoolhouse environment at TRACEN Petaluma. A facilitator coordinated the training, following a process similar to that required at the duty stations. Only the training setting (i.e., TRACEN Petaluma vice a duty station) differed between the CBT Remote Group and the CBT Duty Station Group. All tasks related to the experiment were completed at TRACEN Petaluma.

The Resident Group students received the traditional one-week instructor-led AN/WSC-3 course, delivered at TRACEN Petaluma. All tasks related to the experiment were completed at TRACEN Petaluma.

The effectiveness evaluation was designed in accordance with the 4-level model of Kirkpatrick (1974) and others, with focus on assessment at Levels 1 and 2. The students' reaction to the training formed the Level 1 evaluation, which was assessed using a questionnaire. The Level 2 evaluation addressed the students' mastery of the course, assessing their skills and knowledge during troubleshooting on actual AN/WSC-3 UHF transceivers. This was accomplished with a knowledge test, and with troubleshooting of actual malfunctioning AN/WSC-3(v)7 UHF transceivers. It is important to note that troubleshooting of actual malfunctioning AN/WSC-3(v)7 UHF transceivers for all three groups was performed at TRACEN Petaluma for purposes of experimental control and logistics. These levels provided a cumulative evaluation of the CBT course, relative to the resident course.

Evaluation of the transfer of training from the course to on-the-job performance (Level 3 evaluation) was not performed. The Level 4 evaluation (i.e., changes in organizational performance resulting from the training) was evaluated in the form of training delivery cost (Kingsley, Cummings, and Hammell, 1998).

2.1.2 AN/WSC-3 Course

The AN/WSC-3(v)7 UHF Transceiver Maintenance course was one of several courses considered as the comparative baseline for the evaluation. Members of the USCG project team, selected the AN/WSC-3 course selection after careful consideration of several factors, including:

- Maintenance and operation course content.
- Representative of USCG operation and maintenance courses.
- Reasonable demand for the course.
- One-week length, which was within a feasible CBT development budget.
- Course content was amenable to the CBT medium.
- The current AN/WSC-3 resident course was considered a "good' course, and hence provided a good baseline for comparison with the CBT course version.

2.1.2.1 Instructor-led Resident Course

The instructor-led AN/WSC-3 resident course resides at TRACEN Petaluma. The resident course convenes about 12 times per year, with a maximum class size of six students. The limiting factors on class size are a combination of the number of instructors available, the size of

the room where the class takes place, and the number of AN/WSC-3(v)7 UHF transceivers available at the training center. The one-week resident course is conducted in a laboratory environment, consisting primarily of lecture, discussion, and hands-on maintenance problems using the AN/WSC-3(v)7 UHF transceivers. Each student is given a handbook, which provides detailed guidance tailored to the operation and maintenance procedures used by the USCG for this equipment. A set of U.S. Navy published AN/WSC-3 technical manuals is also used during the training. Successful completion of the course is based on interaction with the instructor during the class. Upon completion of the course the student is given a certificate designating that the student has successfully completed the course. Once a student returns to the duty station, the unit's personnel office processes paperwork (i.e., Career Development Worksheet) which will assign a corresponding qualification code in the student's personnel record. In addition to receiving the certificate upon completion of the course, students complete a standard course critique, which provides data regarding student reaction to the course. The AN/WSC-3 resident course served as the yardstick (baseline) against which the CBT version of the course was compared.

2.1.2.2 CBT Course

The AN/WSC-3 CBT course was developed as interactive courseware (ICW) by Analysis and Technology, Inc., with the subject-matter-expert (SME) assistance of AN/WSC-3 course instructors from TRACEN Petaluma. For economic and investigative reasons, the development goal was to achieve a CBT course that was equivalent to the instructor-led resident course (i.e., not superior to it). The resulting CBT course was developed for delivery on a multimedia laptop computer. The CBT course was divided into seven modules. The first five modules contained instruction on the maintenance and troubleshooting of AN/WSC-3(v)7 UHF transceivers. The sixth module contained a series of troubleshooting practice problems, and the seventh module tested student troubleshooting performance (these test scores were not evaluated in performing the effectiveness evaluation analysis). Student study times were accessible from computer data saved during each training session.

A mixture of tutorial and problem-solving instructional strategies was used, which promoted active student involvement during the training process. Extensive graphics were presented, including diagrams, views of the AN/WSC-3 unit and its internal components, an attention-getting humorous old Electronics Technician Chief to occasionally emphasize certain points, and an introductory video. Much of the instructional presentation used both visual and audio modes of presentation, with headphones provided to minimize interference with others in the work environment. The student-courseware interface was highly refined, and representative of the finest CBT programs available today. The tutorial directed the student in a logical progression through each instruction topic and set of problems, and allowed the student to review any topic on-demand. The students listened to presented information while watching the graphics, answered multiple choice questions, configured and operated a simulated AN/WSC-3(v)7 UHF transceiver, located and removed components, connected external test equipment, and ran tests. It was anticipated that students would require between six and fourteen hours to complete this self-paced course.

An additional component of the CBT course was a two-hour hands-on training segment, to facilitate student transfer of skills and knowledge from the CBT medium to the actual

AN/WSC-3(v)7 UHF transceiver. Since the objective of this investigation was to evaluate the potential of nonresident training, rather than evaluate the strengths and weaknesses of CBT, it was necessary to achieve a CBT course configuration similar to everyday training (i.e., typical production training, rather than a one-time experimental configuration). Therefore, the hands-on training segment was performed following the completion of the CBT portion of the AN/WSC-3 course. For purposes of the study, which included experimental control, the hands-on training segment was performed at TRACEN Petaluma as part of the students' lab familiarization. It should be noted that during normal training activities, any hands-on training required as part of a nonresident course would likely be accomplished at or near the student's duty station.

2.1.3 Experiment Design

A formal experiment was conducted to evaluate the effectiveness of the AN/WSC-3 CBT course at duty stations. The evaluation was based on comparative performance between three different AN/WSC-3 training-delivery treatments, each of which was administered to a separate group of ET students:

CBT Duty Station (DS):	AN/WSC-3 CBT course taught at each student's current duty station.
CBT Remote (RM):	AN/WSC-3 CBT course taught at TRACEN Petaluma.
Resident (RS):	Existing 40-hour AN/WSC-3 course taught at TRACEN Petaluma.

2.1.3.1 Independent Variable

The three training methods (i.e., treatment conditions) comprised the independent variable of the experiment. The comparison between DS and RS groups provided the evaluation of the DS training effectiveness, with the RS group acting as the control. Comparisons between these groups and the RM group provided evaluation of the CBT course's effectiveness when the potential distractions of the duty station environment were removed (i.e., CBT in a training center environment).

2.1.3.2 Dependent Variables (Performance Measures)

Several measures of performance were used as the basis of student and group performance, comprising the dependent variables, as follows:

Posttest – Paper-and-pencil test. This test, used to assess the students' knowledge after completion of the AN/WSC-3 course, was administered to all students at TRACEN Petaluma before the start of other testing activities. Differences between Pretest and Posttest scores were also planned to provide a measure of training gain resulting from the course (Note, the Pretest is addressed in the following subsection).

Hands-on Problems - A practical test in which each student had to troubleshoot and repair malfunctioning AN/WSC-3(v)7 UHF transceivers. The five separate problems were similar to those that an Electronic Technician might experience with a AN/WSC-3(v)7 UHF transceiver at the duty station. Each student's proficiency was evaluated

while solving each problem. Student performance on these problems was considered a reasonable facsimile of their likely performance in similar situations at a duty station, and thus a bottom-line indicator of training effectiveness.

Problem Time - The amount of time the student spent solving each hands-on problem.

Training Time - The amount of time the student spent doing AN/WSC-3 training activities.

2.1.3.3 Additional Student Data

Additional data were collected, as follows:

Pretest - Paper and pencil test, equivalent to the Posttest. It was administered to all students, to assess their knowledge prior to starting the AN/WSC-3 training, and to control for possible imbalance in the student groups.

C-School Critique - Modified versions of the Coast Guard's standard C-School Critique (CGCSCH-5), tailored for each group. The Critique was completed by all students following testing.

Background Questionnaire - Detailed information pertaining to each student's education and experience, collected using a questionnaire format.

The performance measures and the C-School Critique are explained more fully in later subsections.

It should be noted that data were collected for a large number of parameters, with many statistical tests performed. The statistical techniques that generate estimates of significance assume a single test is performed, rather than many tests on different parameters. Consequently, the aggregate set of results has a heightened prospect of finding significant comparisons. This important consideration must be taken into account with the careful interpretation of results.

2.1.4 Students

The student sample consisted of Electronic Technician (ET) and non-rated electronics personnel, who were designated to take the AN/WSC-3 course. The plan was to train a total of 54 students, 18 students in each group. Assignment of students to each group, and to one of the three course sections for each group, was done in accordance with their designation by the USCG Training Quota Center (TQC) prior to the convening of each course section. This student assignment process was considered to be essentially random, for the purposes of data analysis.

A total of 46 students were trained across the three groups. The students in each group consisted of ET-1, ET-2, ET-3 and non-rated personnel. The distribution of students across the groups, and their ratings, are presented in Table 1. The differences between the planned and actual numbers reflect scheduling conflicts. Interestingly, the DS group resulted in the largest number of students.

TABLE 1. DISTRIBUTION OF STUDENTS AND STUDENT-RATINGS ACROSS GROUPS

GROUP	STUDENT RATING				TOTAL (Per Group)
	ET1	ET2	ET3	Non-Rated	
DS	4	4	7	2	17
RM	3	5	7	1	16
RS	3	1	7	2	13
Totals	**10**	**10**	**21**	**5**	**46**

The students in all groups came from a variety of operational units around the country, and from A-School. The duty stations at which the CBT training was conducted were, similarly, a representative cross-section. The DS group students represented both afloat and shoreside units (i.e., 6 and 11 students, respectively), from East, West and Gulf coast locations.

2.1.5 Performance Measurement Tools

2.1.5.1 Hands-On Problems

A "hands-on" test was developed to assess student post-training proficiency in performing AN/WSC-3 troubleshooting and corrective maintenance, working with actual AN/WSC-3(v)7 UHF transceivers in the lab at TRACEN Petaluma. The selected five problems presented realistic troubleshooting and maintenance challenges in a near-work-like environment, similar to that at a duty station.

The student started each problem with a note of some general symptoms, and had to do whatever was required to return that transceiver to service (For example, run tests, diagnose/isolate, remove and replace components). Two senior ETs, acting as independent evaluators, observed and evaluated each student's performance, according to a structured set of criteria. The data from this set of varied tests comprised the student's hands-on problem score.

Each of the five problems was configured by inserting a faulted board, and making other related malfunction changes, in an AN/WSC-3(v)7 UHF transceiver. The five hands-on problems, identified by their respective faults, are listed in Table 2. (The symptoms and corrective action for each problem are identified in Appendix A).

Student Proficiency Assessment. The two evaluators independently assessed each student's performance during each problem, awarding component scores throughout each problem. Student performance was assessed in accordance with pre-determined performance criteria, using a highly structured evaluation technique developed for this experiment. The structure's framework was focused on six dimensions of performance, with task-items under each, which mirrored the general troubleshooting and maintenance process students were expected to follow:

Symptoms
Sectionalization
Localization

Isolation
Corrective Action
Overall Performance (Documentation and Safety)

TABLE 2. LIST OF HANDS-ON PROBLEMS

Problem #	Fault
1	1A1A6 Translator Bypass Module bad
2	1A1A23 5 MHz Oscillator signal bad
3	1A1A16 IF Amplifier Module bad
4	Carrier signal from 1A1A8 Synthesizer module missing
5	Jumpers are not installed on 1A1TB4

The hands-on test process resulted in a single score for each student (i.e., the student problem score), that was arrived at by summing the scores awarded by each evaluator on each problem, and arriving at a grand mean score across the five problems and two evaluators. A weighting schema was used within each problem to address the relative importance of the various troubleshooting and maintenance activities performed. The assessment structure is addressed further in Appendix A.

Summary Judgments by Evaluators. The evaluators judged student summary attributes, in addition to the test-items under the six dimensions identified above. These summary judgments were entered onto the evaluation form after the student completed each problem, and were analyzed separately from the detailed task-item scores. The summary items sought the evaluators' aggregate judgments of the student performance during that problem. The five items were:

Attributes: Confidence
Troubleshooting process
Needs assistance
Attitude

Overall Rating (Proficiency)

Problem Time. Each evaluator independently recorded the start and stop times of each hands-on problem. This provided a measure of the students' troubleshooting and maintenance efficiency. It also provided a means of checking inter-rater reliability, since their start-stop times should have been similar.

Although the hands-on problem assessment approach was a Level-2 evaluation, according to the Kirkpatrick model, the applied hands-on context moved it beyond the typical Level-2, toward that of a Level-3 evaluation.

2.1.5.2 Training Time

The time spent by the student in training was a dependent measure. The time for all RS group students was assumed as 40 hours, the time each student is assigned to the AN/WSC-3 resident course. The training times for students in the DS and RM groups were those recorded by the computer, which kept a log of the times the AN/WSC-3 CBT course was being used.

2.1.5.3 Knowledge Tests (Pretest and Posttest)

The Pretest and Posttest were developed as equivalent, although different, versions of a one-hour multiple-choice test. Each test consisted of two sections: 1) General electronics; and 2) AN/WSC-3. The general electronics section assessed the student's level of general knowledge about electronics theory, operation, troubleshooting and maintenance. The AN/WSC-3 section assessed the student's knowledge about similar topics, but specifically related to the AN/WSC-3. The number of questions in each section were the same for both test variants, as follows:

General Electronics:	19 questions
AN/WSC-3:	27 questions

The Pretest was not a dependent variable of the experiment. Its purpose, rather, was that of a controlling factor, providing data on student entry proficiency. The Posttest, on the other hand, was intended as a measure of student performance resulting from the training. In addition, the difference between Posttest and Pretest scores for the AN/WSC-3 section could provide data for evaluating training gain. The Posttest assessment was considered a Level-2 evaluation, according to the Kirkpatrick model.

2.1.6 C-School Critique

Student reaction to the AN/WSC-3 course, in each of the three groups, was assessed with a student questionnaire, given after completion of all training and testing activities. Three versions of the questionnaires were developed, one for each group. Each of the three questionnaires was based on the standard USCG C-School Critique (1996), using the format and basic set of questions from that document. Additional questions were added for each group, with common questions across the groups when feasible. The resulting questionnaires, therefore, contained a mix of data including: 1) data that were relevant only to the particular training method, 2) data that were comparative across the two CBT training methods, 3) data that were comparable across the three training methods, and 4) data that were collected to maintain commonality with the standard USCG C-School Critique (Questions and responses relevant to only this last category were not analyzed).

The modified C-School Critiques were considered as Level 1 evaluations, under the Kirkpatrick model. Each of the critique questionnaires is contained in Appendix B.

It should be noted that some of the survey questions were included to maintain close compatibility with the standard USCG C-School Critique, and some questions were included as a

check on the experiment logistics at the duty stations. Results from these questions were not addressed in this report.

2.1.7 Other Experiment Materials

Group-specific materials were developed to support the experiment's training and testing activities. These materials were similar across the groups, for similar activities, but were tailored somewhat due to the different conditions experienced by each group of students. Furthermore, the material requirements differed between the CBT groups (DS and RM) and the RS group, due to the training context. The materials used are identified in the subsections that follow (See Appendix C for additional information on the materials).

2.1.7.1 Training Materials

The three student groups used the same reference publications during their respective AN/WSC-3 courses, which were:

AN/WSC-3(v)7 Technical Manuals - Two-volume operation and maintenance manual, developed and published by the U.S. Navy. This is the standard reference for operating, troubleshooting and maintenance.

AN/WSC-3(v)7 Student Guide - Provides troubleshooting guidance and training-related information, augmenting the technical manuals. This document was developed by the USCG specifically to support the resident course.

Student Corrective Maintenance Log Sheets - Blank forms used by students to write down observations and other information during the troubleshooting and maintenance work. All students were instructed to use these forms while working on troubleshooting problems in the course (These forms were also used by the students during the hands-on testing problems).

The DS and RM groups used the AN/WSC-3 CBT medium, in addition to the technical manuals and course book. The computer medium contained the bulk of course material, which was stored on the laptop's hard drive. In addition, the CBT students received a 3-page document, *Computer Turn-On/Off Procedures*, to guide them in the operation of the laptop computer.

The RS group used the standard lab equipment and other media in the AN/WSC-3 lab at TRACEN Petaluma during their course.

Additional information about the two course versions is provided in Section 2.1.2, AN/WSC-3 Course, presented earlier.

2.1.7.2 Group-Specific Materials

The group-specific materials, which were in addition to the training materials identified previously, supported conduct of the experiment for the three groups prior to the TRACEN Petaluma post-training testing activities. They are identified below under each group.

CBT Duty Station Group. Materials were developed for, and sent to, three persons at each duty station: 1) Commanding Officer; 2) Facilitator (the person, usually the student's immediate supervisor, who would oversee the AN/WSC-3 CBT course conduct); and 3) Student. The set of materials consisted of the following:

Facilitator Guideline - Handbook guiding facilitator activities, in support of the CBT and information collection at the duty station.

Facilitator Job Aids - Several aids, such as a check-off sheet, developed to assist the facilitator in performing the requisite tasks.

Student Guideline - One-page document providing general guidance to the student.

Duty Station Facilitator Questionnaire - Survey requesting judgments by the Facilitator about the CBT course.

Student Background Questionnaire - Survey requesting detailed background information about each student. The student filled out this questionnaire.

Pretest – Paper-and-pencil test, equivalent to the Posttest, completed by the student prior to start of the training. See the earlier description.

CBT Remote Group. The RM group used the same materials as the DS group. However, modifications were made to conform to administration of training in the school environment at TRACEN Petaluma.

Resident Group. The RS group materials used prior-to, and during, the training consisted of:

Student Background Questionnaire - Identical to that used by the other groups.

Pretest - Identical to that used by the other groups.

Instructor Guide Supplement - Guidance augmenting the standard *AN/WSC-3 Course's Instructor Guide*, addressing the experiment. This guidance supplement addressed the experiment.

2.1.7.3 TRACEN Petaluma Evaluation Materials

The post-training testing conducted at TRACEN Petaluma was performed the same for each group, and used the same materials, as follows:

Faulted AN/WSC-3 modules - Faulted AN/WSC-3 modules inserted to cause the hands-on problems.

Evaluator Guideline - Handbook guiding evaluator activities during TRACEN Petaluma testing.

Scoring Criteria Guideline; Scoring sheet - Guide and scoring sheet used by evaluators to judge student proficiency during hands-on problems.

AN/WSC-3 UHF transceiver and lab materials - AN/WSC-3 UHF transceivers and associated equipment and tools, used during the hands-on testing.

2.1.8 Procedures

The sequence of experiment activities, which was the same for all groups, is presented in Figure 1. The first four activities were performed at the respective training sites for each group (e.g., at the individual students' duty stations for the DS group). The final three activities were performed at TRACEN Petaluma for all groups. The procedures for conduct of each activity were designed to be similar, in keeping with the context of each group.

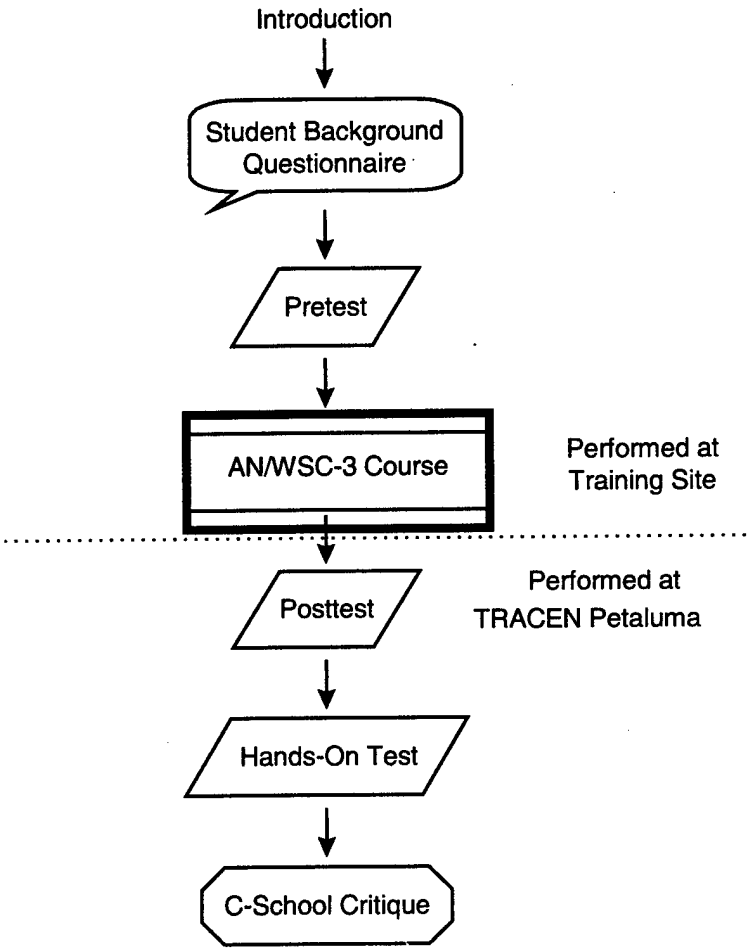

FIGURE 1. MAJOR EXPERIMENT ACTIVITIES

2.1.8.1 Group Sections and Subsections

Each group (e.g., Duty Station Group) was divided into three sections of no more than 6 students per section. As can be seen in Table 3, no two groups or sections participated in the hands-on testing (evaluating AN/WSC-3 troubleshooting skills) during the same time frame. The limit on the number of students that could participate in any one section was based on size of the traditional resident class.

TABLE 3. TRAINING AND HANDS-ON TESTING SCHEDULE

		TRAINING PERIOD		HANDS-ON TESTING	
GROUP	**SECTION**	**BEGIN DATE**	**END DATE**	**BEGIN DATE**	**END DATE**
Resident	1	24 Feb 97	28 Feb 97	3 Mar 97	4 Mar 97
CBT Duty Station	1	24 Feb 97	7 Mar 97	11 Mar 97	12 Mar 97
CBT Remote	1	17 Mar 97	19 Mar 97	20 Mar 97	21 Mar 97
Resident	2	28 Apr 97	2 May 97	5 May 97	6 May 97
CBT Remote	2	19 May 97	21 May 97	22 May 97	23 May 97
Duty Station	2	30 Jun 97	11 Jul 97	15 Jul 97	16 Jul 97
CBT Remote	3	21 Jul 97	23 Jul 97	24 Jul 97	25 Jul 97
Resident	3	18 Aug 97	22 Aug 97	25 Aug 97	26 Aug 97
CBT Duty Station	3	25 Aug 97	5 Sep 97	9 Sep 97	10 Sep 97

To facilitate evaluator observation of the individual students during the hands-on testing, each section was further divided into two subsections of three students each. The five hands-on test problems were also divided up, three on the first day of testing, and two on the second day of testing. Therefore, one subsection would take the first three problems in the morning (referred to as Subsection A), and the second subsection would take the identical three problems in the afternoon (referred to as Subsection B). On the following day of testing, the two subsections would swap time frames. Subsection B would take the final two problems in the morning, and Subsection A would take the final two problems in the afternoon. Table 4 shows the order for one such group of students.

TABLE 4. HANDS-ON TEST PROBLEM SCHEDULE

SUB SECTION	STUDENT	Test Day #1 Problem Start Time						Test Day #2 Problem Start Time					
		0730	0900	1030	1230	1400	1530	0730	0900	1030	1230	1400	1530
A	S1	P1	P2	P3							P5	P4	
	S2	P2	P3	P1							P4	P5	
	S3	P3	P1	P2								P5	P4
B	S4				P3	P2	P1	P4	P5				
	S5				P2	P1	P3		P5	P4			
	S6				P1	P3	P2		P4	P5			

S1-S6: Student identification number (6 students per section)
P1-P5: Problem identification number (5 hands-on problems)

After all students completed a problem, they would move to another AN/WSC-3 rack and start their next problem (Table 4). Students were prevented from talking with each other about their previous problems to maintain testing integrity. To control for potential learning effects during the testing, the order in which students performed the hands-on test problems was balanced within and across subsections, sections and groups.

2.1.8.2 CBT Duty Station Group Procedures

Each unit (duty station) for which a unit member was selected to participate in the CBT Duty Station Group was contacted initially by phone one-month before the training period was scheduled to begin. The phone call to the unit was made by either a representative from the USCG Headquarters' Office of Force Management (G-SRF), or a representative from TRACEN Petaluma. The purpose of the phone call was to inform the unit of the selection, to establish points of contact at the unit, and to identify a facilitator at the unit. The role of the facilitator was to coordinate experiment support activities and AN/WSC-3 training. Following the phone contact, a letter from the Commanding Officer of the R&DC to the Commanding Officer of the unit was sent. The purpose of the letter was to officially request the unit's assistance in performing the experiment, and to inform the unit as to what would be required of them.

One week before the training period was scheduled to begin, a package containing a set of experiment (e.g., knowledge pretest) and training (e.g., multimedia laptop computer with courseware loaded) materials would arrive at the participating unit. This allowed for a one-week preparation period during which the facilitator would become familiar with the requirements of the experiment, inventory materials in the package, and perform a test of the laptop computer. If there were any problems, the one-week preparation period would allow for resolution without interfering with the designated training period.

A two-week CBT training period was specified during which the AN/WSC-3 course would be conducted. On the first day of the training period, the facilitator administered the student

background questionnaire and Pretest. From that point on, the student was to perform the course at the student's own pace. The student was requested to complete the course by the last day of the training period. The facilitator was instructed not to get involved in the student's training process.

Immediately following completion of the two-week training period, the student was sent on Temporarily Assigned Duty (TAD) to TRACEN Petaluma for the post-training and testing. It should be noted that students were sent TAD even if they did not complete the CBT course, and there were at least two students who were not able to complete all of the CBT course. These two students experienced an unexpected, and extraordinarily high, workload at the duty station during the training period. As with all the students in this group, there were no additional opportunities for these students to complete the CBT course once they reported to the TRACEN Petaluma lab for the post training and testing period.

Six DS students, at different duty stations, received the training simultaneously, and reported together at TRACEN Petaluma for the testing. The procedures for the DS group were:

- Contact the duty station, one-month prior to training activities.
- Reception of the training and experiment support materials one week before start of the training period.
- Pre-training activities, including:
  - Student Background Questionnaire
  - Pretest.
- Conduct of the AN/WSC-3 CBT course, during a 2 week training period. Course completion.
- Student travel to TRACEN Petaluma for testing.
- Conduct of testing at TRACEN Petaluma, including:
  - Hands-On Training and Lab Familiarization
  - Posttest
  - Hands-on test (5 problems)
  - C-School Critique

2.1.8.3 CBT Remote Group Procedures

The group of six RM students reported to TRACEN Petaluma on the day before the start of training and experiment activities, similar to the RS students (i.e., Sunday). The students gathered Monday morning for the start of training, in a classroom remote from the AN/WSC-3 lab where hands-on testing would be conducted. The facilitator provided an introduction, and administered the student background questionnaire and Pretest at the start of training. The AN/WSC-3 CBT course then commenced. The students had a little over two days in which to complete the course, before the start of testing activities late Wednesday morning. The students were allowed to train at their own pace, with the provision that they had to finish the course by late Wednesday morning.

The post-training and testing process began late Wednesday morning, and concluded Friday afternoon. Hands-on testing was conducted on Thursday and Friday. This testing process was

identical to that of the DS and RS groups, with the exception of the time schedule, which differed for each group.

The procedures for the RM group were:

- Pre-training activities at TRACEN Petaluma, including:
  - Student Background Questionnaire
  - Pretest
- Conduct of the AN/WSC-3 CBT course, during a two-plus day training period. Course completion.
- Conduct of testing at TRACEN Petaluma, including:
  - Hands-On Training and Lab Familiarization
  - Posttest
  - Hands-on test (5 problems)
  - C-School Critique

2.1.8.4 Resident Group Procedures

The RS students reported to TRACEN Petaluma on the day before the start of training and experiment activities, similar to the RM students (i.e., Sunday), and in accordance with the normal practice for the traditional resident course. The students began training Monday morning, as usual for the AN/WSC-3 resident course. The instructor started the course with an introduction to the experiment, and administered the student background questionnaire and Pretest. After that point, and until the conclusion of training activities Friday, the AN/WSC-3 course was conducted in accordance with normal practice, with no deviations for experimental purposes.

The post-training and testing process began Friday afternoon, and concluded during Monday and Tuesday of the following week. The hands-on tests were conducted Monday and Tuesday. This process was identical to that of the DS and RS groups, with the exception of the time schedule, which differed for each group.

The procedures for the RS group were:

- Pre-training activities at TRACEN Petaluma, including:
  - Student Background Questionnaire
  - Pretest.
- Conduct of the resident AN/WSC-3 course, during a 4-1/2 day training period. Course completion.
- Conduct of testing at TRACEN Petaluma, including:
  - Lab Familiarization
  - Posttest
  - Hands-on test (5 problems)
  - C-School Critique

2.2 DUTY STATION IMPLEMENTATION ANALYSIS METHODOLOGY

A major by-product of the training technology experiment was a group of USCG duty stations, and staff, that had first-hand experience with nonresident CBT (i.e., through participation in the DS group). Interviews were conducted with staff at a subset of the participating duty stations, to generate information that can assist the USCG in effectively implementing nonresident CBT training. The purpose of the interviews were to:

- Identify important issues and potential problems associated with implementation of nonresident CBT at duty stations.
- Identify alternative actions for dealing with the issues and problems. These were to be generated from suggestions during the interviews.

2.2.1 Duty Stations Interviewed

The implementation analysis consisted of interviewing relevant staff at the duty stations. The selection of duty stations was constrained to assure interviews with East Coast, Gulf Coast and West Coast units. The interviews were conducted shortly after completion of all experimental training and testing. By so doing, the interview discussions did not affect the training or testing activities.

Interviews were conducted over a period of about 2-1/2 months, with the following duty stations:

East Coast: Engineering Support Unit, Portsmouth, VA
Medium Endurance Cutter *CGC DEPENDABLE*, Portsmouth, VA
Research & Development Center, Groton, CT

Gulf Coast: Engineering Support Detachment, Corpus Christi, TX

West Coast: Engineering Support Unit, Honolulu, HA
Ice Breaker *CGC POLAR STAR*, Seattle, WA
Sea-Going Buoy Tender *CGC COWSLIP*, Astoria, OR

These duty stations comprised about half of the units at which the AN/WSC-3 CBT course was conducted, and about 60% of the DS group students.

2.2.2 Duty Station Staff Interviewed

The primary staff to be interviewed at each duty station were (Note, not all units had an Education Officer and Training Officer):

Commanding Officer or Executive Officer
Student's immediate supervisor (who often was the facilitator)
Education Officer and/or Training Officer

Other appropriate persons were also interviewed, such as the students. A total of 27 interviews were conducted. Most interviews were with one person at a time; some interviews were with multiple persons.

2.2.3 Interview Form, Content and Process

A structured interview form was developed to identify the major interview dimensions, and list the questions. It contained 53 questions, with sub-questions, grouped under the following dimensions:

AN/WSC-3 CBT: Overall
Duty Station: Training Space & Environment
Time Available to Train
Training Disruptions & Interference
Training Management
Student
Training Process
Organization Issues

The interview form was intended to provide guidance only, as opposed to a constrained interview procedure. The goal was to conduct the interviews in a conversational format, allowing for the interviewee to raise important issues and discuss ideas. Hence, the order of the questions differed somewhat during each interview based on the responses from the interviewee.

The interviews were conducted with two interviewers present: one representative from Paradigm Associates, and one representative from R&DC. Usually, the interviews were with one duty station person at a time; some interviews were with multiple persons in a small group setting. The interviews ranged in time from about 1 to 2 hours, generally requiring about 1-1/2 hours to complete.

3 TRAINING EFFECTIVENESS RESULTS

The results obtained from each of the student performance measures and the other evaluation instruments are presented in this section of the report.

3.1 HANDS-ON TROUBLESHOOTING PERFORMANCE

Student performance during the hands-on problems was considered the single most important indicator of training effectiveness, since it required applied student performance in an environment closely replicating that of an operational unit. Each of the 46 students were scored on all five hands-on problems by the two evaluators, in accordance with the specified scoring process, yielding a total of more than 8000 assessment data points across the students.

The analysis of the hands-on problem data was performed in three parts, with a fourth part addressing the evaluators' reliability.

3.1.1 Student Problem Scores

The resulting mean problem scores achieved by each group are presented in Table 5. The mean problem score is the average of student scores for each problem, in each group (An explanation of the scoring process is in Section 2.1.5, Performance Measurement Tools; and in Appendix A, Hands on Problems, Description and Scoring). Student scores on individual problems ranged from about 57% to 100%. As can be seen, the mean problem scores for each group were near 90%. The RM group achieved the highest mean score, closely followed by the DS group, and the RS group. A one-way analysis of variance (ANOVA) design was performed to evaluate group differences, with the following results:

- A significant main effect was found for the student group variable (training-delivery method), $F(2,43) = 3.818$, $p < 0.03$.
- A significant difference was found between the RM and RS groups ($p < 0.05$), using the Tukey H test to evaluate specific group differences. The RM group performed better than the RS group.
- No significant differences were found between other group comparisons (i.e., DS versus RS, DS versus RM, and CBT (DS + RM) versus RS).

TABLE 5. MEAN HANDS-ON PROBLEM SCORES FOR EACH STUDENT GROUP

Hands-on Problem #	Student Group: CBT Duty Station (DS)	CBT Remote (RM)	Resident (RS)
1	91.92	92.35	87.89
2	92.36	93.80	90.42
3	91.83	87.68	92.01
4	88.16	91.46	83.54
5	94.78	94.74	85.48
Mean	**91.81**	**92.00**	**87.87**

These results indicate that the AN/WSC-3 CBT course, both at the duty station and at the training center, was as effective as the instructor-led AN/WSC-3 resident course.

3.1.2 Summary Evaluator Ratings

The mean evaluator ratings of the summary attributes for students in each group are presented in Table 6. These represent the bottom-line evaluator judgments of each student, following completion of each hands-on problem. The tabulated ratings are the group means, calculated across students and problems for each group. Inspection of this table shows that the ratings were similar across the three groups for each attribute. The order of the ratings were consistent for each attribute, with the RM group achieving the highest mean, closely followed by the DS group, and the RS group. No significant difference was found between groups for any of the attributes, based on a one-way ANOVA performed on the data of each attribute, as follows:

- Confidence, $F(2,43) = 0.146$, $p < 0.864$
- Troubleshooting Process $F(2,43) = 0.667$, $p < 0.87$
- Assistance Need $F(2,43) = 0.815$, $p < 0.449$
- Attitude $F(2,43) = 0.119$, $p < 0.888$
- Overall Rating $F(2,43) = 0.837$, $p < 0.44$

TABLE 6. MEAN HANDS-ON PROBLEM SUMMARY RATINGS FOR EACH STUDENT GROUP

Summary Attribute	Student Group		
	CBT Duty Station (DS)	CBT Remote (RM)	Resident (RS)
Confidence	3.04	3.09	2.98
Troubleshooting	3.02	3.07	2.89
Assistance Need	2.94	3.06	2.85
Attitude	3.54	3.60	3.53
Overall Rating	2.66	2.81	2.55

These results indicate that the students receiving the AN/WSC-3 CBT course, both at the duty station and at the training center, exhibited attributes equivalent to graduates of the instructor-led AN/WSC-3 resident course.

3.1.3 Problem Solving Time

The students' problem-solving times are presented in Table 7. The times are the group means, calculated in minutes, across students and problems. The data show that the shortest mean time was achieved by the RS group, followed by the RM group, and the DS group. No significant differences in problem-solving time were found between groups (Based on a one-way ANOVA, $F(2,43) = 2.57$, $p < 0.088$). However, the closeness to significance suggests a trend may be present in the data, meaning that a significant difference may exist; additional research is necessary to establish if a difference does exist. Nevertheless, the closeness of the problem solving times suggests that, if a difference were later found, it would be relatively small.

TABLE 7. MEAN TIME TO SOLVE THE HANDS-ON PROBLEMS, FOR EACH GROUP

	Student Group		
	CBT Duty Station (DS)	CBT Remote (RM)	Resident (RS)
Problem Solving Time (min.)	58.89	56.48	51.15

3.1.4 Inter-Evaluator Reliability

The reliability of the student evaluations, performed by the two evaluators, was estimated by: 1) correlating the student problem scores between the two evaluators; and 2) correlating the problem solving times between the two evaluators. The correlation of problem scores was expected to yield a reasonable estimate of the inter-evaluator reliability, as regards the hands-on problem scores. The correlation of the problem solving times, on the other hand, was viewed as a check on the evaluators' reliability, but not a reasonable estimate of the student problem score reliability. This later correlation should be high if the evaluators performed reliably, since the problem solving times should be very similar between evaluators. The results of these analyses were;

- The inter-evaluator score correlation for the hands-on problems was found to be moderate to high ($r = 0.71$), and highly significant ($p < 0.001$).
- The inter-evaluator problem solving time correlation was very high ($r = 0.94$), and highly significant ($p < 0.001$).

These results indicate that the hands-on problems' evaluation process conducted at TRACEN Petaluma was satisfactorily reliable.

3.2 STUDENT KNOWLEDGE

Student knowledge, as measured by the Pretest and Posttest, is reported in this subsection. All students in each group completed both the Pretest and the Posttest. However, certain discrepancies occurred during administration of the tests, which constrained the analysis and interpretation of results.

- The DS group scores on the AN/WSC-3 part of the Pretest were not in conformance with those of students in the other two groups. Hence, the usefulness of Pretest data was limited. This was most probably due to a combination of factors, including the duty station environment (e.g., lack of tight experimental control).
- The posttesting of the final section of DS students, which was also the final section of students tested, had to be accomplished two to four weeks after the students completed the course (i.e., compared with several hours to 2 days later for the other students in all groups). This posttesting delay introduced potential contamination into the data (e.g., retention effect).

For these reasons, only partial analyses of the knowledge tests were performed. Table 8 presents the mean raw scores achieved on the Pretest and Posttest, including the General and AN/WSC-3 part-scores. Note, the raw scores are the number of questions answered correctly. Also, note that the number of questions differed on each part (i.e., 19 questions on the General part, and 27 questions on the AN/WSC-3 part). The tests were constructed to be difficult, thus providing a high potential for achieving meaningful differences between the Pretest and Posttest, if training was effective. The "Posttest - Pretest" column represents the difference between Posttest and Pretest scores.

TABLE 8. PRETEST AND POSTTEST SCORES

Test Part	Training Group	Pretest	Posttest	Posttest - Pretest
General (Out of 19 questions)	CBT Duty Station	10.82	11.41	0.59*
	CBT Remote	9.44	10.94	1.50
	Resident	10.15	11.62	1.47
AN/WSC-3 (Out of 27 questions)	CBT Duty Station	9.71	17.00	7.29*
	CBT Remote	6.81	16.13	9.32
	Resident	5.54	18.46	12.92
TOTAL SCORE (General & AN/WSC-3)	CBT Duty Station	20.53	28.41	7.88*
	CBT Remote	16.25	27.06	10.82
	Resident	15.69	30.08	14.39

*Note: These values may reflect discrepancies that occurred during administration of the pre- and post-tests of the Duty Station Group. (See section 3.2)

3.2.1 Student Entry Characteristics

Inspection of Table 8 shows that the general student entry characteristics, as measured by the general part of the Pretest, were stronger than those related to the AN/WSC-3. The mean score on the Pretest-general part, across all three groups, was about 53% (The group means were between 50% and 57%). In contrast, the mean score on the Pretest-AN/WSC-3 part, across groups, was about 28%. These relative student characteristics were, of course, expected. They indicate students had little knowledge on how to operate and maintain a AN/WSC-3(v)7 UHF transceiver prior to the course.

3.2.2 Training Gain

The difference in student scores between the Pretest and Posttest, particularly on the AN/WSC-3 part, provided a measure of training gain during the course. The resident course, based on discussions with USCG personnel, was assumed to be effective, and thus was the yardstick for comparison with the two CBT courses. Repeated measures ANOVA's were performed on the Pretest and Posttest scores for each group, to evaluate training gain. The data problems encountered with these tests, as noted above, acted to reduce the observed training gain for the DS group; hence, this analysis was considered valid, and conservative.

3.2.2.1 AN/WSC-3 Part of Test

The AN/WSC-3 part of each test was of most interest, since it was the focus of the course. Significant training gains were found in the AN/WSC-3 part or each group, based on performance improvement from the Pretest to the Posttest (RS group, $F(1,12) = 208.5$, $p < 0.001$; DS group, $F(1,16) = 26.05$, $p < 0.001$; RM group, $F(1,15) = 84.12$, $p < 0.001$). These results show that the students in each of the three training method groups performed significantly better after completing the respective courses. The magnitude of the changes, as shown in Table 8, indicates substantial increase in student knowledge as a result of each course.

3.2.2.2 General Part of Test

The general part of each test was expected to show only a small gain between the Pretest and Posttest, since the AN/WSC-3 course only indirectly addressed general electronics topics. The mean scores of the general part of the Posttest show a small increase over those of the Pretest, for each group. No significant differences were found between the Pretest and Posttest in the general part, for any of the groups (RS group, $F(1, 12) = 2.892$, $p < 0.115$; DS group, $F(1, 16) = 0.402$, $p < 0.535$; RM group, $F(1, 15) = 3.553$, $p < 0.079$).

3.2.3 Post-Training Knowledge

The Posttest scores were analyzed to determine if significant group differences existed in student knowledge after completing the course. This analysis was questionable, because of the possible data contamination noted earlier. No significant differences were found between the three training methods (Posttest-general part, $F[2, 43] = 0.267$, $p < 0.767$; Posttest-AN/WSC-3 part, $F[2, 43] = 2.288$, $p < 0.114$).

3.3 STUDENT REACTION TO THE AN/WSC-3 CBT COURSE

This subsection addresses the students' reactions to the AN/WSC-3 CBT course, and to training at duty stations. The critique results are both presented and discussed in this section.

The investigation of student reactions to the course centered around those of the DS group, with the focus on duty station training. The RM group reactions were important with regard to their similarity or difference in comparison with those of the DS group, particularly as related to the training environment. The reactions of the RS group were important in comparison with the combined DS and RM group reactions, providing data related to the comparison of traditional training methods with CBT.

The student response frequencies for all Likert-type questions in the C-School Critiques, for each of the three student groups, are listed in Appendix E. Some questions, which were included in the critique to be compatible with the standard USCG C-School Critique, were not of specific interest to this study and are not discussed.

Note, the findings reported in this section often compliment those obtained from the duty station interviews, which are addressed Section 5, Duty Station Implementation Analysis Findings.

3.3.1 Reaction to Duty Station Training

Student responses to the 44 Likert-type questions and the 6 open-ended questions of the DS Group's critique were analyzed in sets of related questions.

3.3.1.1 Effectiveness of AN/WSC-3 CBT Course

The DS group responses to the 4 Likert-type questions that addressed the training effectiveness of the AN/WSC-3 CBT course are presented in Table 9. The number of students that selected each question response category (i.e., frequency), is listed for each question. The statement associated with each question number in the table paraphrases the actual question (The course critiques are in Appendix B, containing the precise statement of each question).

TABLE 9. DS GROUP JUDGMENTS ABOUT EFFECTIVENESS OF AN/WSC-3 TRAINING

Questions Regarding Effectiveness of Training	Question Response Categories (Frequency of Student Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
1. Confident in ability to maintain AN/WSC-3	0	0	0	12	5
26. Training quality was satisfactory	0	0	3	11	3
27. Course was effective overall *	0	0	0	13	3
28. CBT course as effective as traditional course	0	1	9	5	2
32. Computer satisfactory for practice	0	1	3	11	2

Note: * denotes one or two students failed to answer question

Inspection of Table 9 shows that the large majority of students agreed with the statements. Nearly 80% of the student responses (i.e., 67 of the 84 responses) were in the "Agree" or "Strongly Agree" categories, indicating that most students judged the CBT course to be effective. All students agreed that the CBT course was effective overall, and that they were confident in their ability to maintain the AN/WSC-3(v)7 UHF transceiver (questions #27 and #1). Most students judged the training to be satisfactory, although several (about 18%) disagreed (question #26). Similarly, most students judged the computer as satisfactory for practice, although about a quarter of the students disagreed, with one student strongly disagreeing (question #32). In contrast to these findings, less than half the students (about 41%) judged the CBT course to be as effective as a traditional course (question #28). This DS group finding differs substantially with reactions of RM group students, all of whom agreed or strongly agreed that the CBT course was as effective as a traditional course. It is suggested, therefore, that the disagreeing DS student responses to question #28 reflect specific difficulties that those students experienced during implementation of the CBT at their respective duty stations. This issue is addressed further in a following subsection (Section 3.3.2, Comparison of Duty Station Student Reactions with Other Groups).

The results presented in Table 9 generally agree with those obtained from the hands-on tests, and the Pretest and Posttest. Most students judged the AN/WSC-3 CBT course to be satisfactory and effective.

3.3.1.2 AN/WSC-3 CBT Course Content

Student responses to the 14 questions addressing the content of the AN/WSC-3 CBT course are presented in Table 10. With the exception of question #3, the large majority of responses agreed or strongly agreed with the statements (i.e., 188 of 213 responses, or 88%) (question #3 responses, and the 4 responses in the "N/A" category were not included in this calculation). This indicates very positive student reactions to most of the course content. In contrast, most students judged that additional practice was needed during the course, as indicated by the disagreeing responses to question #3 (i.e., 11 of 16 responses, or 69%). This need for additional practice was echoed in the open-ended responses, as addressed below, and also by the RM group. With the exception of practice, therefore, the AN/WSC-3 CBT course content was judged favorably by the students. This finding coincides with the students' judgment of the course as effective.

TABLE 10. DS GROUP JUDGMENTS ABOUT DESIGN AND IMPLEMENTATION OF THE AN/WSC-3 CBT COURSE

Questions Regarding Design and Implementation of Course	Question Response Categories (Frequency of Student Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
3. Practice was sufficient	0	1	10	6	0
4. Proper troubleshooting techniques were taught	0	0	2	13	2
5. Troubleshooting problems were realistic	0	0	0	14	3
6. Course was presented in a logical sequence	0	0	0	14	3
7. Course length was ideal *	0	0	4	12	0
8. Proper tools & equipment available on computer	1	1	1	12	2
9. Spare parts available in computer medium *	1	0	1	11	2
13. HELP information enhanced learning	0	0	0	12	5
14. Course work related to course objectives	0	0	0	15	2
23. Training time was never wasted	1	1	3	9	3
29. Instruction detail was sufficient *	0	0	4	11	1
30. Course was challenging	0	0	4	13	0
31. Amount of general theory was sufficient	0	1	3	11	2
35. Computer & software worked satisfactorily	1	0	0	7	9

Note: * denotes one or two students failed to answer question

The student responses to the open-ended questions provided information amplifying on the results in Table 10. The following were cited as the most beneficial parts of the CBT course (question #45):

- Inherent characteristics of duty station CBT, such as:
  - Self-paced nature of CBT
  - Graphical presentation
  - Learning at the student's duty station
  - AN/WSC-3 information access at any time
  - Able to review at any time

- Time savings that accrue from CBT
- Aspects of the AN/WSC-3 course, such as:
  - Troubleshooting methods
  - BITE test explanation and faults
  - Knowing which boards to check

Despite the very positive student response to the CBT course, several areas of improvement were identified. Insufficient practice problems were cited, by several students, as the least beneficial part of the course (question #46). Furthermore, nearly half the students cited the need for more practice problems in response to question #47, which asked about additional information and materials for improving the course. The need for more practice problems was again cited under question #50, which sought suggestions for improving CBT at duty stations. In general, across all questions, the need for additional practice problems was the most-often cited improvement wanted for the AN/WSC-3 CBT course. These results, together with the predominant disagreeing response to question #3, clearly identify the need for more practice problems in the CBT course.

Several other improvement needs, cited by one or more students in response to questions #46, 47 and 50, are listed below, in order of how-often cited:

- Provide additional theory, such as how modules work, operation of individual circuits, power distribution, troubleshooting schematics, and signal tracing.
- Provide hands-on training at the duty station, rather than at the training center following completion of the CBT part.
- Improve specific CBT characteristics, such as a more convenient means of backtracking during training.
- Remove non-essential parts of the CBT course, such as the salty-chief cartoon character.
- Provide a means for the student to interact with an instructor.

An important aspect of the CBT course content was its ease of use (i.e., user interface). Student judgments on the three questions addressing the user interface are presented in Table 11. As can be seen, the students judged the user interface very favorably, with only a small proportion of students disagreeing (i.e., 47 of 49 responses agreed or strongly agreed, representing 96%) (the 2 "N/A" responses were not included). This result suggests that the user interface likely contributed to the effectiveness of, and complimented, the course content.

TABLE 11. DS GROUP JUDGMENTS RELATED TO THE USER INTERFACE

Questions Regarding User Interface	Question Response Categories (Frequency of Student Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
34. CBT materials were user friendly	1	0	1	6	9
36. I had no difficulty learning to use computer	0	0	0	5	12
41. I had no difficulty conducting the CBT	1	0	1	11	4

The above findings provide evidence of a satisfactory and effective AN/WSC-3 CBT course having been conducted at duty stations. They also indicate that some students had difficulty training, identify areas of potential improvement to this CBT course, and identify areas that should be given more attention in future courses (e.g., practice problems, and hands-on training at duty stations).

3.3.1.3 Duty Station Environment

The duty station environment was the context in which the AN/WSC-3 CBT course was conducted for DS group students, and in which future nonresident training (e.g., CBT, IVT) may be conducted. Consequently, the student reactions to their training environment are of particular importance. Student responses to the eight questions addressing the duty station training environment are presented in Table 12. In aggregate, the majority of students agreed with the statements, indicating a generally positive student reaction to the training environment at duty stations (i.e., 92 of 132 responses agreed or strongly agreed, representing 70% of the responses) (the 4 "N/A" responses were not included). Some students, however, disagreed or strongly disagreed with each statement, suggesting considerable differences in the training environments across the DS group. More importantly, the results suggest that 30% of the students, on average, judged aspects of their training environment as not conducive to training. This finding has important ramifications for effective implementation of nonresident training, highlighting the need to carefully design, and control, the duty station training environment.

TABLE 12. DS GROUP JUDGMENTS RELATED TO THE TRAINING ENVIRONMENT

Questions Regarding Training Environment	Question Response Categories (Frequency of Student Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
20. Training environment was functional	1	2	2	9	3
21. Good visibility in training space	0	0	3	10	4
22. No distractions during training	0	2	5	7	3
37. Training environment was satisfactory	0	0	5	8	4
38. Available time for course was adequate	0	1	5	8	3
40. Command supported AN/AN/WSC-3 CBT	2	0	1	8	6
42. CBT at duty station was convenient	0	1	6	6	4
43. Little interference during training	1	1	6	5	4

The most positive responses in this set of questions were given to question #40, which addressed command support for the experimental CBT course. All but one student agreed that their command supported the training, an important finding. Nevertheless, although the command support was widespread, the distractions, interference and available training time apparently were not always favorable to the duty station training.

Information in the open-ended questions amplified on these findings. Interruptions were cited, by several students, as the least beneficial part of the CBT course (question #46). More importantly, the predominant response to question #50 (i.e., suggestions for improving CBT at duty stations) cited factors directly related to management of the training/work environment as

the key to nonresident training success. These included elimination of interruptions; integration of training, and work prioritizing and scheduling; and increasing command emphasis on training. Two-thirds of the students cited the need to develop a strong command commitment to duty station training, and thus reduce interference to students during training. These findings, together with those cited earlier, suggest that widespread command support by itself is not enough to assure an adequate training environment. The duty station training process must be purposely configured and actively controlled. This is a fundamental issue that must be resolved if nonresident training is to succeed in a duty station training environment.

3.3.1.4 Facilitator Functioning

The facilitator's functions at the duty stations were primarily in support of the experiment, rather than the CBT course. However, large-scale implementation of nonresident training (e.g., CBT, IVT) at duty stations will require some level of oversight by a training coordinator, such as the facilitator used in this experiment. Student judgments about the facilitator, therefore, provided insight into the potential functioning of a duty station training coordinator.

Student responses to the 4 questions pertinent to facilitator functioning are presented in Table 13. Although the median responses to all questions were in the "Agree" category, student reactions differed considerably on each question. Between 53% and 71% of the students agreed with the statements, representing an aggregate of 62% agreeing or strongly agreeing (i.e., 40 of 65 responses agreed or strongly agreed) (the 3 "N/A" responses were not included). This result suggests differences of opinion among the students regarding facilitator functioning. This finding is complimentary to the training environment issues addressed earlier in regard to Table 12.

TABLE 13. DS GROUP JUDGMENTS RELATED TO FACILITATOR FUNCTIONING

Questions Regarding Facilitator Functioning	Question Response Categories (Frequency of Student Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
16. Answered all questions	0	1	7	7	2
17. Maintained control	0	0	7	8	2
18. Capably assisted training process	0	0	6	8	3
19. Enforced safety standards	3	0	4	7	3

The Table 13 results suggest considerable variance across duty stations. They imply that the facilitators usually did an adequate job, although not in all cases, indicating room for improvement. This finding, which is complimentary to the training environment issues addressed earlier in regard to Table 12, is particularly meaningful. The training coordinator at each duty station is likely to play a pivotal role in establishing and maintaining the training environment. This person's role will probably be exceptionally important to the acceptance and effectiveness of nonresident training during the early stages of implementation.

3.3.2 Comparison of Duty Station Student Reactions with Other Groups

The reactions of the DS group students were directly relevant to the investigation of the nonresident AN/WSC-3 training, as addressed above, representing the Level 1 evaluation. Comparison of the DS group reactions with those of the RM and RS groups provided additional insight into training implementation issues. Contingency tables presenting the student response frequencies for each question in the C-School Critiques, for each group, are provided in Appendix E.

Most of the RM and RS students showed positive reactions to their training, as exhibited by the large majority of student responses in the "agree" or "strongly agree" categories. The percentage of disagreeing or strongly disagreeing responses for all questions, for both groups, ranged from 0% to 33%. Greater than 20% disagreement occurred on only 3 questions in the RM group, and on none in the RS group. Strong disagreement was expressed on only 2 of 610 responses (0.3%) of the RM group, and on 4 of 363 responses (1%) of the RS group. Hence, it can be concluded that the two variations of AN/WSC-3 training provided at the training center (i.e., CBT and traditional instructor-led) were received by the students at least as positively as that provided at the duty stations.

The DS group reactions were contrasted with those of the RM and RS groups, by comparing the distribution of responses between groups on similar critique questions (i.e., similar Likert-type questions). The questions analyzed were those addressed earlier regarding the DS group data in Tables 9 - 13. Note, some of the critique questions differed for each group, in accordance with the respective training methods; hence, the three groups were not compared on all questions. Statistical analyses found significant differences in response patterns on 10 similar questions, between the DS group and the RM and/or RS groups. Table 14 presents the questions for which significant differences were found between groups, and the response distributions for each group. The questions in this table were arranged in accordance with their discussion in the previous subsection (3.3.1 Reaction to Duty Station Training), including the question groupings addressed in Tables 9, 10, 11 and 13 (No significant differences were found on questions from Table 12).

The Chi-Square analysis results obtained for the questions in Table 14 were listed in the order that they appear in Table 13 (Note, the category "N/A" data were included in these analyses):

- Question #28 - DS, RM: (X^2 [1] = 7.15, p=0.008)
- Question #3 - DS, RM: (X^2 [1] = 3.88, p=0.049); DS, RS: (X^2 [1] = 9.94, p=0.002
- Question #20 - DS, RM: (X^2 [1] = 4.45, p=0.035); DS, RS: (X^2 [1] = 4.26, p=0.039)
- Question #22 - DS, RM: (X^2 [1] = 6.81, p=0.009)
- Question #16 - DS, RM: (X^2 [1] = 4.29, p=0.038); DS, RS: (X^2 [1] = 6.87, p=0.009)
- Question #17 - DS, RM: (X^2 [1] = 13.48, p=0.000); DS, RS: (X^2 [1] = 6.05, p=0.014); RM, RS: (X^2 [1] = 4.00, p=0.045)
- Question #18 - DS, RS: (X^2 [1] = 5.74, p=0.017)
- Question #19 - DS, RS: (X^2 [1] = 4.36, p=0.037)

TABLE 14. COMPARISON OF DS WITH RM AND RS GROUPS, ON QUESTIONS WITH DIFFERENCES

Questions	Student Group	Question Response Categories (Frequency of Student Responses)				
		N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
Effectiveness of AN/WSC-3 Training (Table 9)						
28. Course as effective as traditional course	DS	0	1	9	5	2
	RM	0	1	0	10	5
Design and Implementation of the CBT Course (Table 10)						
3. Practice was sufficient	DS	0	1	10	6	0
	RM	0	0	5	11	0
	* RS	0	0	1	9	2
Training Environment (Table 11)						
20. Training environment was functional	DS	1	2	2	9	3
	RM	0	0	0	10	6
	* RS	0	0	0	7	5
22. No distractions during training	DS	0	2	5	7	3
	RM	0	0	0	9	7
Facilitator Functioning (Table 13)						
16. Answered all questions	DS	0	1	7	7	2
	RM	0	0	3	7	6
	RS	0	0	0	9	4
17. Maintained control	DS	0	0	7	8	2
	RM	0	0	0	5	11
	RS	0	0	0	9	4
18. Capably assisted training process	DS	0	0	6	8	3
	RS	0	0	0	7	6
19. Enforced safety standards	DS	3	0	4	7	3
	RS	1	0	0	6	6

Note: * denotes one or two students failed to answer question

The DS group, on each of the above questions, had a lower proportion of agree and/or strongly agree responses than did the comparative group(s). A significant difference was also found between the RM and RS groups on only one question, #17.

Caution should be exercised when interpreting these statistical results, since the statistical method assumed only a single test was performed, although a relatively large number of tests were performed (i.e., one test for each question in the C-School Critique). Consequently, a heightened probability of finding statistically significant group differences existed for these analyses. If a conservative correction factor was applied to all results, the only significant difference found at the 0.05 level would have occurred on question #17, between the DS and RM groups. On the other hand, the relatively large number of significant differences found on the sets of related questions suggest a consistent underlying effect may have been present, as discussed below.

A common thread appears through most of the questions in Table 14. All, but questions #28 and 3, directly or indirectly pertain to the duty station training environment. Questions #20 and 22 explicitly address the training environment. Questions #16, #17, #18 and #19 address the CBT facilitator in the DS and RM groups, and the instructor in the RS group; these persons were certainly an integral part of the training environment for each group of students. The aggergate of results suggests that, although the duty station training was generally considered effective and acceptable by the DS students, the training center environment (i.e., TRACEN Petaluma) resulted in a higher proportion of positive student reactions. It appears that the facilitator (and instructor) had a substantial impact on the students' reactions to the respective courses. Discussion with some of the duty station students following the testing at TRACEN Petaluma, as well as comments made in the C-School critiques, indicated that students had widely differing experiences interacting with their facilitator. The duty station facilitator, therefore, appears to be an important element that may substantially affect the students' reaction to duty station training. Particular care must be exercised in the development of facilitator skills, and the execution of the facilitator-type functions in support of duty station training.

The DS and RM groups differed significantly in their judgement of the CBT course in compariosn with traditional courses (question #28). A high proportion of RM group students judged the CBT course as equivalent to a traditional course (i.e., 15 of 16 student responses agreed or strongly agreed, or 94%), while only 41% of the DS group students expressed similar judgements (as reported earlier). The significant difference between these groups is suggested to be due to the training environment, since 1) the groups differed significantly in their reactions to their respective training environments (i.e., questions #20, #22, #16 and #17), and 2) the CBT courses were identical for both groups. The training environment was the only major factor that differed between the two groups.

In addition, the duty station facilitators were, in many instances, the students' immediate supervisors. It should be expected that these supervisors may have been more concerned with operational issues than with training and experiment issues, during the period of AN/WSC-3 training. The RM group facilitator, on the other hand, was a TRACEN Petaluma staff person dedicated to the training. The RM group facilitator would, therefore, be expected to have had an attitude more in accordance with training concerns during the AN/WSC-3 course, as would the resident course instructor. The importance of command support of training at all levels within the command, including that of the immediate supervisor, is likely to be essential to the conduct of effective training.

The differences between the DS and RM groups regarding sufficient practice (question #3) is attributed to training environment differences, following a rationale similar to that for question #28, since the practice problems were identical for both groups. Despite these group differences, a clear need was identified for additional practice problems in the CBT course. The DS group clearly identified this need, as discussed earlier (Section 3.3.1.2, AN/WSC-3 CBT Course Content). The RM group also identified this need, notwithstanding their significantly less disagreeing response to question #3. The 5 "disagree" responses to question #3 by the RM group was the highest number of disagree or strongly disagree responses by these students to any question (Note, question #7 also had 5 disagree or strongly disagree responses). The significant

differences between the DS and RS groups in this regard, further indicates the need for additional practice problems in the AN/WSC-3 CBT course.

3.3.3 Application of Nonresident CBT

The DS and RM group students provided suggestions pertaining to the conduct of training at duty stations, in their responses to the open-ended questions, and in their general remarks. The critique results reported in preceding subsections identify many of the student observations and suggestions for improvement. The results reported in this subsection augment those previously reported. Note, some students provided multiple response to a question, all of which were included in the analysis. Hence, the total number of responses, in some instances, exceeded the number of students responding.

Thirteen of the DS group students responded to question #48, requesting additional AN/WSC-3 topics for inclusion in the course. Nine RM students provided responses. Four DS students and one RM student said no additional topics were necessary; the course was considered complete. Suggestions from the remaining students, combined across the DS and RM groups, were:

- Five suggestions identified additional theory, such as signal flow, antenna theory and logic circuits.
- The remaining suggestions identified other topics, such as:
  - Test equipment
  - Planned Maintenance
  - Crypto
  - Remote head
  - Secure communications
  - AN/WSC-3 variants
  - Parts locator function
  - SATCOM
  - Alignment

Fourteen DS group students provided over two dozen recommendations in response to question #49, asking for suggestions of other USCG training areas or courses in which CBT might be effective. Twelve RM group students provided over a dozen recommendations. The suggestions included specific equipment, as well as general areas of skill and knowledge. They were, combined across the DS and RM groups:

- Specific equipment identified for application of nonresident training were:
  - AN/SPG69 radar
  - GLH-100 Loud Hailer
  - GSB-900 transceivers
  - MCX-1000
  - DF
  - HFDL
  - Standard Workstation 3
  - Cabling and fiber optics
- General areas identified for application of nonresident training were:

A-School (completely replace)
SysOp School
Introduction to all communications equipment
Navigation rules
Refresher training
Basic computer training
General electronic fundamentals
Any equipment at the Unit
Most equipment on a small boat
Simple hardware
Most courses
All correspondence courses (replacement for)

3.3.4 Summary of Student Reaction Findings

The students reacted in a generally positive fashion to the nonresident AN/WSC-3 CBT course (DS group), as well as to the training center application of the CBT course (RM group) and the traditional instructor-led resident course (RS group). The CBT course design was judged positively, including the general experiment-training interface at the duty station. Certain areas of needed improvement to the CBT course were identified (e.g., providing additional practice problems), as well as improvements to the duty station training environment (e.g., need to reduce interruptions of the student). Command support was rated positively, as was facilitator functioning. However, a relatively wide range of student reactions was present in the questions-responses pertaining to the facilitator, suggesting that the facilitators often did an adequate job, although not in all cases. The critique data from the two resident training groups (RM and RS) suggested student reactions similar to those of the DS group, although appearing more positive. Certain findings further suggested that the training center student groups had a more positive reaction to the training due to the training center environment, in comparison with the duty station environment. The establishment and execution of a duty station environment conducive to training was, therefore, identified as an important implementation concern.

3.4 FACILITATOR JUDGMENTS ABOUT THE AN/WSC-3 CBT COURSE

This section addresses the duty station facilitators' reactions to the AN/WSC-3 CBT course, and to nonresident training overall. Fourteen duty station facilitators provided responses to all questions in the Facilitator Questionnaire, excepting question #15, for which 13 responses were received. The response frequencies for the Likert-type questions are listed in Table E-4 of Appendix E. Selective results are presented and discussed in this section.

The primary purpose of the Facilitator Questionnaire was as a check on the training-experiment process conducted at the duty stations, in the unlikely event of major problems with the implementation. Consequently, the questions addressed issues related to the implementation. The student data, as observed in the preceding sections, showed that the duty station implementation of this experiment was satisfactory. The facilitator questionnaire data were similar, in that the majority of responses agreed or strongly agreed with the question statements. Only 14% or less of the responses disagreed on any statement; and, only 1 response (of 209 total responses) strongly disagreed with any statement.

The level of command support and facilitator support for the nonresident training were the issues of greatest interest addressed in the questionnaire. The facilitators generally agreed with the students that their command supported the AN/WSC-3 CBT course, as evidenced by the high proportion of agree and strongly agree responses to question #1 (i.e., 13 of 14 responses, or 93%). The facilitators judged their own support for CBT as very positive, in response to question #14 (i.e., 9 of 14 responses were in the "strongly agree" category; 4 were in the "agree" category; and only 1 was in the "disagree" category). These reactions coincided with those of the students, providing strong support for nonresident training. The facilitators cited a variety of potential benefits to accrue from training at duty stations, in their responses to question #16:

- Convenience for the duty station was cited by most of the facilitators. This included the student being trained nearby in case of an emergency; ability to train without adversely affecting the unit's operational effectiveness; ease of scheduling (i.e., in comparison with fitting a student into the limited available course slots); reduction in time away for training; and the duty station workload reduction, since the student can still perform work during the period of training, at a reduced level.
- Other responses cited by one or more facilitators included:
  - Self-paced training benefits for the student
  - Advantages of computer interaction for troubleshooting
  - Cost savings, particularly travel costs
  - CBT stimulation of student interest
  - Comfortable training environment

The general arrangements, including support materials, for the conduct of the training-experiment at the duty stations were judged highly by the facilitators, as shown in their responses to the four questions presented in Table 15. All facilitator responses were in the "agree" or "strongly agree" categories, denoting high agreement across facilitators (one response was in the "N/A" category). The arrangements and materials supporting the CBT course and experiment were, therefore, well-received by the facilitators.

TABLE 15. FACILITATOR JUDGMENTS RELATED TO GENERAL TRAINING-EXPERIMENT ARRANGEMENTS

Questions Regarding General Arrangements	Question Response Categories (Frequency of Student Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
2. Materials satisfactorily received	0	0	0	5	9
3. Received materials were sufficient	0	0	0	5	9
4. Facilitator guidance was satisfactory	0	0	0	9	5
15. Student travel arrangements were satisfactory	1	0	0	6	7

Facilitator reactions to the training-experiment process conducted at the duty stations are presented by their responses to the six questions in Table 16. The overall reactions were positive, as indicated by the high proportion of responses agreeing with the question statements (i.e., 76 of 84 responses were in the "agree" or "strongly agree" categories, or 90%). Several facilitators did, however, indicate some problems by their reactions, especially regarding the

scheduling of training and the presence of interferrence during training sessions (questions #6 and #8). These are addressed further below, in terms of the facilitators' responses to the open-ended questions. Nevertheless, most facilitators did report a satisfactory experiment-training process.

TABLE 16. FACILITATOR JUDGMENTS RELATED TO TRAINING-EXPERIMENT PROCESS

Questions Regarding Training-Experiment Process	Question Response Categories (Frequency of Facilitator Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
5. Facilitation task performed satisfactorily	0	0	2	8	4
6. Scheduling of training performed satisfactorily	0	1	1	8	4
7. Finding training space was not a problem	0	0	1	7	6
8. Training sessions ran smoothly	0	0	1	7	6
9. Little interference during training	0	0	2	6	6
10. Interaction with student was satisfactory	0	0	0	8	6

Open-ended questions #17, #20 and #21 requested judgments about problems and how to improve training at duty stations. Several responses were cited multiple times, while others were unique. The responses were:

- Scheduling of training was cited by several facilitators as an issue critical to the success of duty station training. They included the following:
  - The command must provide the student sufficient time to complete the training.
  - Training and work task scheduling should be integrated. Training should be scheduled like any other task during the normal work day.
  - The unit should have flexibility to schedule training in accordance with operational demands.
- Training disruptions (i.e., interferring with the student's training process) was cited by several facilitators as a potential problem. The training environment must be free from distractions. Students also identified this as a problem, several having experienced disruptions during their CBT course.
- Additional responses identifying potential problems and suggestions for improvement were:
  - Establish a permanent facilitator at each duty station (cited by several facilitators). One response suggested eliminating the facilitator.
  - Have all CBT hardware and software located permanently at units (cited by several facilitators).
  - Testing: Automate testing; perform testing at each unit; have USCG Institute perform all testing.
  - Have dedicated spaces for training at each unit.
  - Give facilitator longer lead time before the start of the course.
  - Need to have procedures to secure hardware and software from potential theft.
  - Need scheduling of sufficient facilitator time (similar to student time, above).
  - Student motivation may be a problem

The quality of the CBT course was judged highly by the facilitators, as shown by their responses to the questions in Table 17. All but one response agreed or strongly agreed with the statements, showing substantial concurrence among the facilitators. The facilitator reactions about the course quality agree well with those of the students.

TABLE 17. FACILITATOR JUDGMENTS RELATED TO AN/WSC-3 CBT COURSE QUALITY

Questions Regarding Course Quality	Question Response Categories (Frequency of Facilitator Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
11. Self-paced method was convenient	0	0	1	6	7
12. CBT media quality was satisfactory	0	0	0	6	8
13. Computer & software worked satisfactorily	0	0	0	4	10

The facilitators provided a variety of suggestions for improving the AN/WSC-3 CBT course (i.e., questions #18 and #19), such as:

- Elimation of the technical manuals.
- Mandatory use of the maintenance log sheets during the course.
- Providing additional clarifications to the CBT content.
- Editorial and logisitics suggestions for the Facilitator Guidelines.

In summary, the facilitators' reactions coincided well with those of the students. The facilitators were positive about the CBT course conducted at their duty stations, indicating generally high approval of the arrangements, materials and course content. They indicated that the course was supported by their command, and that nonresident training has good potential. They also indicated several areas that must be carefully addressed to assure nonresident training is effectively implemented.

4 TRAINING EFFECTIVENESS DISCUSSION

This section addresses the combined results, as they pertain to the effectiveness of nonresident CBT at duty stations. Data were collected using a variety of measures, as reported earlier. The consistency of results across these measures, as well as the results pertaining to inter-evaluator assessments, indicates good reliability in the data and confidence in the results.

4.1 TRAINING GAIN

Each of the training methods were effective in student achievement of AN/WSC-3 knowledge, as demonstrated by significant gains between the AN/WSC-3 part of the Pretest and that of the Posttest (See Table 8). The absence of a corresponding significant increase in scores on the general part of the tests suggests that the courses were highly focused on AN/WSC-3 content. These findings, alone, indicate that the three training methods were effective. And, most importantly, these findings demonstrate the potential for nonresident training in the USCG.

4.2 EFFECTIVENESS OF THE TRAINING METHODS

The preceding subsection identified the achievement of training gain for each training method, and their training effectiveness. This subsection addresses similarities and differences in training effectiveness between the three training delivery methods.

4.2.1 Hands-On Test Problems

Student performance in solving the five malfunctioning AN/WSC-3 hands-on problems was considered the single most important measure relating to the effectiveness of the training at duty stations. This test replicated, to a degree, the types of problems and working environment ETs would encounter in the field. Each hands-on problem began with a simple statement of the trouble-symptom and current situation at a duty station (problem statements are presented in Appendix A). The student was left alone to troubleshoot and repair the AN/WSC-3(v)7 UHF transceiver, using available test equipment, technical manuals, and other resources that would typically be available at the duty station. Several students later commented that the test environment was very similar to that of a duty station, and unlike a typical training environment. This test was viewed as a bottom-line measure of the student's proficiency in solving applied AN/WSC-3 maintenance problems. The highly structured evaluation process, together with the two independent evaluators, added to the relative importance of this measure.

The Resident group (RS) was used as the comparative baseline for evaluation of the CBT course, which included both experimental delivery contexts (i.e., duty station and training center environments). As noted earlier, the instructor-led resident course was considered an effective USCG course. The student performance reinforced that opinion, finding a large significant training gain to result from the resident course. The AN/WSC-3 CBT course development goal was to achieve a nonresident version of the AN/WSC-3 course that was equivalent to the instructor-led resident version.

The mean hands-on problem scores achieved by students in each group, across the five problems, are shown in Figure 2. The statistical analysis found that the CBT Remote (RM) group performed significantly better than the RS group. On the other hand, no significant differences were found between the CBT Duty Station (DS) and RM groups, nor between the DS and RS groups. Furthermore, inspection of Figure 2 shows that the mean scores between all groups were very close. The RM group achieved the highest score, but only by a very small margin above the DS group (i.e., much less than 1%). And, the difference between these two CBT groups and the RS group was also small (i.e., about 4%). Finally, each group achieved the highest mean score on at least one of the five problems (See Table 5). These collective results suggest little meaningful difference between the training methods (i.e., approximate parity of the training methods). That is, for practical purposes, the three training methods were approximately equivalent in achieving AN/WSC-3 qualified ETs. These results demonstrate that a Coast Guard non-resident CBT operation and maintenance course taught at duty stations can be equal in effectiveness to a traditional resident course taught at a training center.

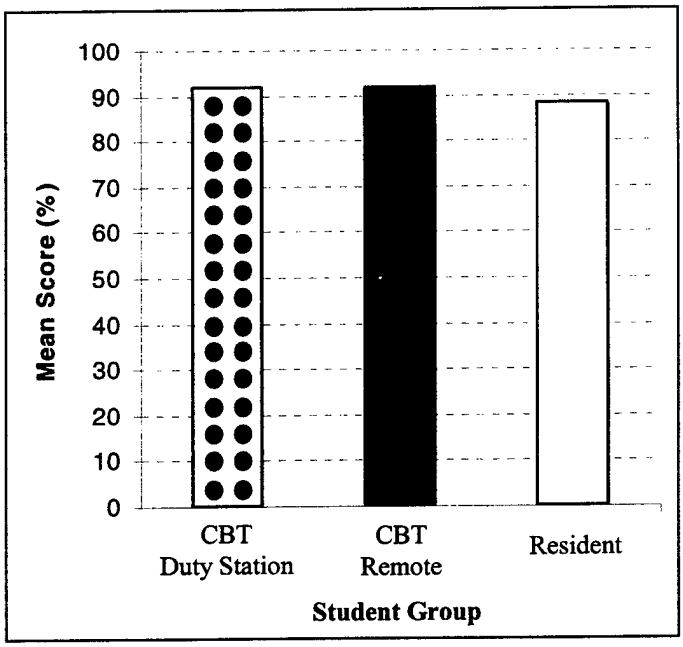

FIGURE 2. HANDS-ON TEST MEAN SCORES FOR EACH GROUP

This important finding was supported by the consistency obtained between the hands-on problem scores (Figure 2) and the evaluators' summary judgments about performance during each hands-on problem. Figure 3 shows the mean Overall Rating awarded by the evaluators for each training method group. The order of these overall ratings across the groups agree with that of the student performance scores cited above (i.e., RM group, followed by DS group, and then by RS group). This consistency between judgments at different levels of evaluation attests to the reliability of the training effectiveness results.

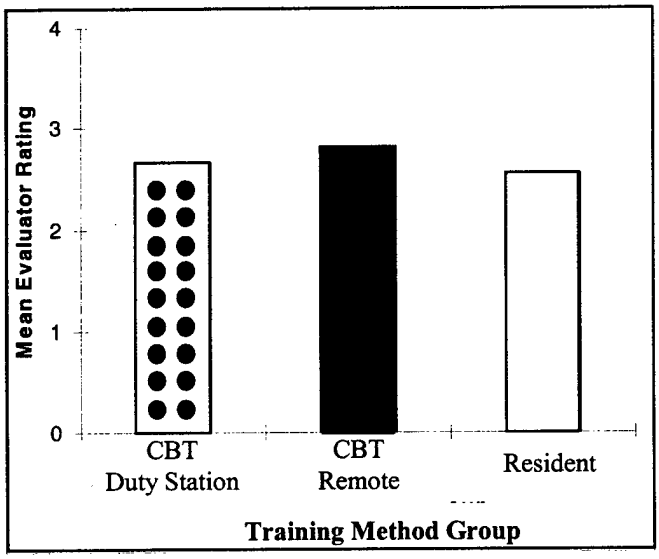

FIGURE 3. OVERALL PROFICIENCY RATINGS OF STUDENTS DURING HANDS-ON PROBLEMS

The evaluator summary judgments of the other student attributes were similarly consistent across groups, as shown in Figure 4. The relative differences between groups were the same for each of the other four attributes (i.e., RM group, followed by DS group, and then followed by RS group). Furthermore, the mean rating differences between groups for each attribute were relatively small, resulting in the finding of no significant group differences on any of the attributes.

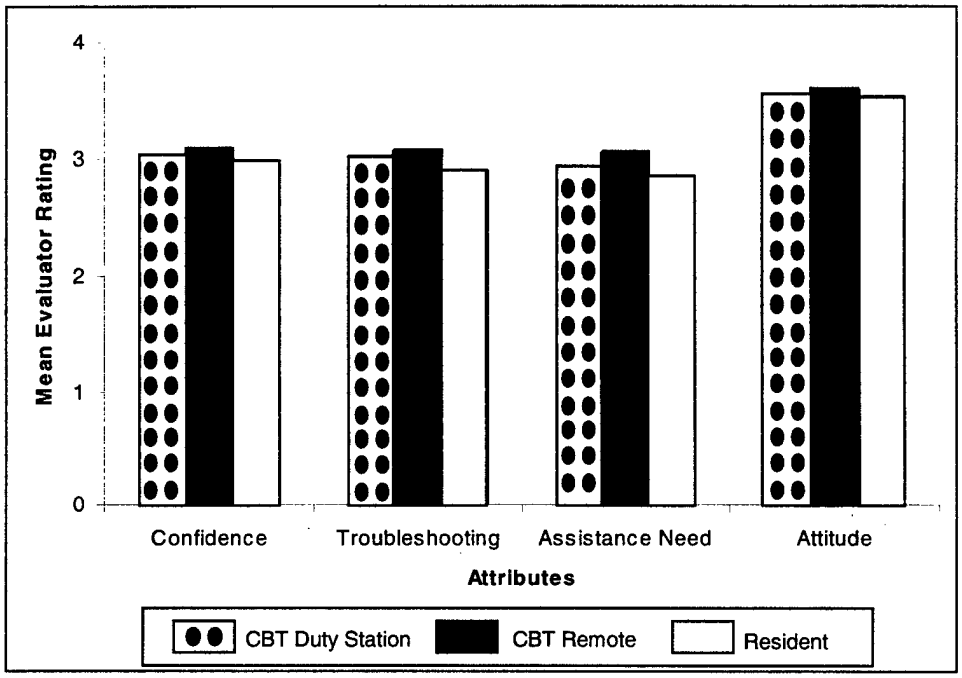

FIGURE 4. OTHER ATTRIBUTE RATINGS OF STUDENTS DURING HANDS-ON PROBLEMS

The multiple results of student performance during the hands-on problems clearly demonstrate that nonresident CBT methods can be as effective as traditional resident training methods. Based on the premise that the resident AN/WSC-3 course was effective, these findings further show that nonresident CBT is effective. Finally, and most importantly, the findings show that training at Coast Guard duty stations can be equally effective to similar training at a training center.

4.2.2 Posttest

Student performance on the Posttest, following completion of the respective AN/WSC-3 courses, showed a pattern similar to that of the hands-on problems (See Figure 5). This time, however, the RS group scored highest, with the DS group in the middle, and the RM group achieving the lowest mean Posttest score. This pattern was the same for the General and AN/WSC-3 parts of the Posttest. Importantly, the three groups again differed by relatively small amounts on each of these parts. The statistical analyses did not find significant differences between the three groups, on either the AN/WSC-3 part or the General part.

The Posttest results, therefore, demonstrate findings similar to those of the hands-on problems. The CBT course was equally effective to the traditional resident course. Of greater importance, the CBT course conducted in the nonresident duty station environment was equally effective to both the traditional resident course and the CBT course conducted in the training center environment.

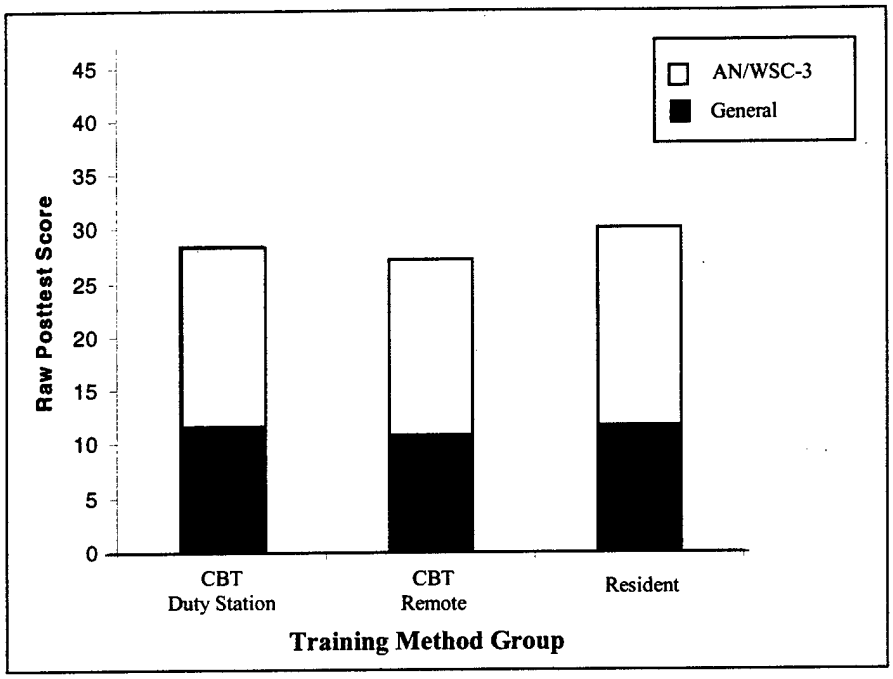

FIGURE 5. POSTTEST RAW SCORE, INCLUDING GENERAL AND AN/WSC-3 PARTS

4.2.3 Problem Solving Time

Similar to most of the training effectiveness results, the mean problem solving time for the hands-on problems did not differ significantly between the three training method groups. Figure 6 shows the mean time to solve the hands-on problems for each group. The range of student times is shown by the brackets around the mean for each group (Note, the maximum time for any problem was 90 minutes). Substantial time ranges existed within each group, on most problems. These large time differences between students in each group negated the possibility of significant time differences between groups. The problem solving time results, like the preceding student performance data, indicate approximate equivalence between training method groups, and hence resident and nonresident training delivery.

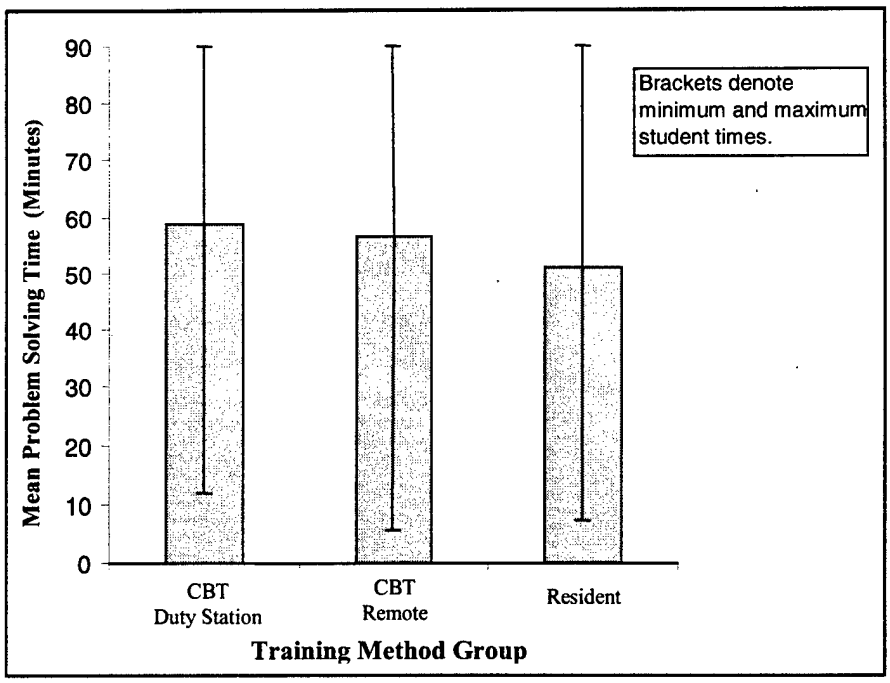

FIGURE 6. TIME SPENT SOLVING HANDS-ON PROBLEMS

4.3 SUMMARY INTEGRATION OF TRAINING EFFECTIVENESS FINDINGS

The two sets of student performance data, paper-and-pencil test and hands-on troubleshooting problems, have found approximately equivalent student achievement in each of the three training method groups. The CBT course was found to be as effective as the traditional instructor-led resident course. More importantly, computer-based training at duty stations was found to be equally effective to instructor-led training at a resident training center. This finding has important implications for the future direction of the USCG's training system. It provides the USCG with greatly expanded options for achieving cost-effective training delivery.

It is important to recognize that these findings pertain to the potential effectiveness of training at duty stations. They are limited in addressing 1) the type of training that would be effective at duty stations; and 2) the duty station conditions necessary to support effective training. It is unlikely that all current USCG training could be effectively conducted as CBT courses at duty stations. Nevertheless, it is likely that a substantive subset of current training may be effectively accomplished at duty stations.

The results of the C-School Critique analysis support the major test findings, indicating that the nonresident CBT was effective, and as effective as the traditional resident training. However, the critique responses also suggest that student attitudes toward the nonresident CBT, while positive, were not as strongly positive as those toward resident-based training (i.e., whether CBT or instructor-led training methods). This was attributed to differences in the duty station and resident training center environments. This indicates a need to carefully construct, and maintain, the duty station environment in a manner conducive to the achievement of training.

This experiment, and the duty station training that was conducted, was accomplished under controlled conditions. Although relatively little direct control was exerted over the duty station conditions during each student's training, the level of attention and coordination with each duty station unit certainly helped to motivate the personnel involved. Even though some students did report training situation difficulties at their duty stations, it is reasonable to assume that the CBT training received a fair amount of attention. For this reason, the results should be interpreted as representing the potential of nonresident CBT in the USCG (i.e., if duty station training is appropriately managed, and supported by the various levels within the USCG infrastructure). Achievement of reliably effective training at duty stations, on a regular production training basis, is likely to require serious change in the way the USCG conducts business at duty stations. The student critique and implementation analysis interviews identify issues related to implementing nonresident training at Coast Guard duty stations.

4.4 TRAINING TIME

The time required to complete the AN/WSC-3 course is an important factor. Not for evaluating the course's effectiveness, but rather for evaluating the course's efficiency and cost. Before reviewing the training time results, it is important to note that the duty station training time data suffered from the same control limitations as the Pretest data (Pretest control problems noted earlier in this report). The training time was automatically recorded by the computer when the AN/WSC-3 CBT course was in use. However, the recording made no distinction regarding purpose of use (e.g., computer left unattended during operation). Consequently, the obtained results for the CBT Duty Station Group must be cautiously interpreted as the training environment was not controlled. Due to this method of accumulating the duty station time data, the amount of time recorded was never an underestimation of the actual training time, but may have been an overestimation in some cases.

There are three known instances where the recorded training times may be considered an overestimation. In one instance, a student in the CBT Duty Station Group accidentally left the laptop computer running and failed to exit from the CBT courseware after completing a section of the course. The result was a total training time of 33:31 hours:minutes recorded for this student. The second and third instances in the CBT Duty Station Group involved a facilitator who was surprised to see how quickly the two members of his unit completed the CBT portion of the course, and therefore directed the two members to go back through the courseware one more time. All three of these recorded training times were used in calculating the arithmetic mean time for the CBT Duty Station group to complete the CBT portion of the AN/WSC-3 course.

Despite the overestimation of training completion times for the CBT Duty Station Group, the mean (average) training times recorded for the two CBT groups (presented in Table 18) are impressive when compared to the completion time for the instructor-led resident version of the course (also presented in Table 18).

TABLE 18. STUDENT TRAINING TIME (HOURS:MINUTES)

GROUP	CBT COURSEWARE TIME (arithmetic mean)	HANDS-ON TRAINING TIME	TOTAL TIME
CBT Duty Station	10:56	2:00	12:56
CBT Remote	5:49	2:00	7:49
Resident	N/A	N/A	36:00

The total time for the resident student to complete the instructor-led AN/WSC-3 course is 36 hours. In the instructor-led course, hands-on time on the actual AN/WSC-3 UHF transceivers and time performing other classroom activities (e.g., listening to the instructor lecture) varies based on instructor preference and the ability of the attending class. Therefore, no attempt is made to separate the Resident student's time by category in Table 18.

The arithmetic mean time for the CBT Duty Station student to complete the CBT portion of the course was 10:56 hours:minutes. Adding the 2-hours required to complete the Hands-on Training portion of the course to the arithmetic mean time to complete the CBT portion of the course (10:56 hours:minutes), the total time to complete the course is 12:56 hours:minutes. When compared to the time required to complete the instructor-led resident version of this course (36 hours), the arithmetic mean time to complete the course is reduced by 64% when taking the CBT version of the course at the duty station. Of interest, if the time recorded for the student who failed to turn-off the computer after completing a session of training were to be removed (33:31 hours:minutes), the arithmetic mean time for this group would drop to 10:09 hours:minutes.

The arithmetic mean time for the CBT Remote student to complete the CBT portion of the course is 5:49 hours:minutes. The lower completion time in comparison to the CBT Duty Station students reflects the isolation from the duty station environment, and the closer facilitator oversight that is experienced by the CBT Remote students at TRACEN Petaluma. Adding the 2-hours required to complete the Hands-on Training portion of the course to the arithmetic mean time to complete the CBT portion of the course (5:49 hours:minutes), the total time to complete the course is 7:56 hours:minutes. When compared to the time required to complete the instructor-led resident version of this course (36 hours), the arithmetic mean time to complete the course is reduced by 78% when taking the CBT version of the course at a training center.

The difference in course completion times between the CBT Remote group (7:56 hours:minutes) and the CBT Duty Station group (12:56 hours:minutes) indicates that training completion times at duty stations could be shortened. Decreasing course completion times at the duty station would most likely require increased facilitator oversight and/or the creation of an environment at the duty station that is more conducive to training. These types of changes come at a cost, and therefore, a cost-benefit analysis would have to be performed to determine if decreasing the student's time to complete a nonresident course at the duty station is worth the additional cost.

5 DUTY STATION IMPLEMENTATION ANALYSIS FINDINGS

This section presents the findings of the implementation analysis interviews conducted at duty stations. The findings of this section:

- Identify important issues and potential problems associated with the implementation of nonresident CBT at duty stations.
- Suggest approaches and considerations for dealing with many of the issues and problems, to achieve effective implementation of nonresident CBT at duty stations.

The issues, problems and suggested approaches stem directly from the interviews. Also included were information from discussions with some duty station group students at TRACEN Petaluma, and findings of the Student C-School Critique. It should be recognized that considerable in-depth investigation is required to develop suitable solutions to many of the issues and problems identified.

It should be noted that many of the issues identified, and recommendations proposed in this section, would be common to other nonresident media considerations (e.g., interactive video-teletraining.

5.1 OVERALL OPINION OF NONRESIDENT CBT

The majority of persons interviewed showed strong support for nonresident CBT. They generally expressed the belief that nonresident CBT can and will work at duty stations, and that it is good for the USCG. This strong support was present at all levels of persons interviewed (e.g., Commanding officers, supervisors, students), whether on ships or at shore stations, and in all three of the major duty station areas (i.e., East, Gulf and West Coast units). Examples of specific comments received were:

"Just do it"
"A real plus for duty stations"
"Exciting", "good idea" and " nonresident training will work"

A wide variety of reasons for the strong positive opinions were cited, several by most persons, as follows:

- **Less adverse impact** than resident training on the overall team's ability to perform its mission.
- **Unit flexibility** - To meet training and operating needs. This was cited by persons in most units as a major factor in support of nonresident CBT. The opinion was that major training needs are difficult to meet today, due to limited school quotas, course scheduling conflicts, and limits on the number of staff who can receive training in a particular skill area. The nonresident courses would give the units flexibility in determining their training needs, scheduling and conducting training.
- **Assists minimally-staffed vessels**. Some stated that nonresident CBT was a "key" to success with minimally-staffed vessels, since it reduced student separation time and

overall training time. It was also stated, in this regard, that nonresident CBT would allow more cross-training of staff.

- **Assist with general unit training requirements**. Several units, particularly the cutters, stated that they had a variety of training to accomplish with most new crewmembers, such as damage control qualification. A computer-based nonresident training capability, if also addressing these training needs, would provide substantial assistance. It would reduce training time, and free other staff at the unit from instructor duty.
- **Availability of staff while undergoing training**. Staff members would be available to assist with emergencies. If the CBT course were conducted only during a portion of the workday, which would likely occur in most courses, the staff member would be available to perform a portion of their normal workload during the day.
- **Eases unit staffing problems**. Several persons felt that units are often understaffed. Nonresident CBT, with the student still available to participate in some daily work, would ease their staffing problems.
- **Minimizes unit disruptions**. Other staff members must fill-in during a student's absence for resident training, causing general staff disruptions. Nonresident CBT will reduce or eliminate such disruptions.
- **Training efficiency**. The reduced training time typically associated with a CBT course was viewed as a net time/resource savings to the unit. It was suggested that, in comparison with nonresident training (e.g., CBT, IVT, correspondence), resident-based training is inefficient.
- **Training process benefits**. These included:
  - Self-paced training, enabling learning at the student's preferred rate.
  - Able to return to previously learned material.
  - Refresher training, at a later date.
  - Greater consistency across multiple offerings of courses.
- **Individual student benefits**. These included:
  - Benefit to families, by reducing separation time.
  - Reducing hassles associated with travel expenses and claims.
  - Less training time (i.e., which is usually associated with CBT courses).

Only one individual who participated in the CBT Duty Station group, expressed serious doubt about nonresident CBT. His doubt was not based on an opinion that nonresident CBT was fundamentally ineffective, but rather on the belief that the USCG policies necessary to effectively conduct such training at duty stations would not be realistically implemented. His opinion was based, in part, on his experiences during the experiment (e.g., he had to train on his own time, at home). Furthermore, he expressed an opinion of not liking computers. Generally, however, the interviewed students were positive about the potential of nonresident CBT, contributing to the reasons cited.

Although the persons interviewed were positive about the potential of nonresident CBT, they also identified a variety of potential drawbacks to its effective implementation. These issues are addressed in later subsections. The potential problems represent real threats to the successful implementation of nonresident CBT. Nevertheless, it was the opinion of most persons interviewed (i.e., all persons but the one student noted above) that all of the identified problems can be overcome, and successful nonresident training can be implemented. However, it was also

the opinion of many persons interviewed that careful and decisive actions must be taken by the USCG to assure that these problems are adequately controlled, or else the nonresident CBT will not be successful.

5.2 OPINIONS ABOUT THE AN/WSC-3 CBT COURSE

This subsection presents the opinions of duty station staff regarding the AN/WSC-3 CBT course used in the experiment.

5.2.1 General Duty Station Staff Opinions

The duty station staff interviewed were generally positive about the AN/WSC-3 CBT course, similar to their opinions regarding nonresident CBT in general. It should be noted that not all persons interviewed had actually observed the CBT course, although all were at least generally aware of it. The comments included the following observations:

- **AN/WSC-3 CBT course was effective.** Virtually all persons stated this opinion, to the extent they were familiar with the course. The students stated that they were comfortable with the AN/WSC-3(v)7 UHF, and the idea of working on it, although not all students actually had performed work on their unit's AN/WSC-3. At the other extreme were individuals who had not actually seen the CBT course, but had heard that it was a good course.
- **Attitude toward the AN/WSC-3 CBT course changed** after exposure to the course. Several persons reported that their initial thoughts about the course were negative. They expected a relatively poor course. However, their attitude changed with use of the course, to one of praise.
- **Several suggestions for improvement of the AN/WSC-3 CBT course** were:
  - More practice problems needed. This was also identified in the C-School Critique.
  - Additional detailed notes should be provided, such as shortcuts and experience insights (i.e., Similar to information an instructor would provide).
  - Alignment problems were wanted.
  - Manuals should be put on the computer.

These observations are important to the implementation analysis, since they represent the near-term basis for individual judgments about nonresident CBT.

5.2.2 Student Opinions

The student opinions about the AN/WSC-3 course, in addition to the reports in the preceding subsection and those regarding the C-School Critique responses cited earlier, provided information regarding the context in which their training was conducted. Most of the students interviewed noted that their AN/WSC-3 CBT training was conducted under difficult circumstances. Problems noted included:

Absent facilitator
Training on personal time
Training while on TAD, away from their unit to perform work
Interruptions from various persons, for a variety of reasons
Uncomfortable space

Generally, students gave the opinion that they considered the duty station context, as it was when they took the AN/WSC-3 CBT course, difficult for training. Furthermore, it was their opinion that, for nonresident CBT to succeed, the duty station context must be changed to be supportive of training activities. These issues, and others, are addressed further in later subsections.

5.3 TRAINING INTERFERENCE, TIME AND SURROUNDINGS

The duty station environment in which training occurs can have a substantial impact on the effectiveness and efficiency of the training process. Three components of the training environment were identified as potentially major problems:

- Interference with the student during a training session.
- Time available for conduct of the student's training session.
- Disruptions due to the surroundings (i.e., location and space in which training is conducted).

These three components are closely related, in terms of the potential problems, as well as their potential solutions. Each problem is addressed in a separate subsection, bearing in mind that they overlap. The potential solutions are addressed together in the final subsection, integrated across the problems.

5.3.1 Interference Problem

Interference with a student who is actively engaged in a training session is considered a potentially major problem facing the implementation of CBT at duty stations. This expected problem was identified by most of the persons interviewed. The potential adverse impact of interference is multi-faceted, including:

- **Reduced training effectiveness**, to the extent that course objectives are not achieved.
- **Reduced training efficiency**, requiring substantially increased time to complete the course.
- **Reduced student comfort and heightened anxiety**, stemming from their concerns regarding operational issues. This can be very disruptive to their training process.
- **Reduced student motivation**, which can adversely impact the training effectiveness and efficiency.

Training interruptions may occur in many forms such as: a fellow worker asking a brief technical question; noise onboard the ship; pressure from a supervisor to finish the training session quickly so the student can get back to the work task; and, premature termination of the training session because the student is being sent on an urgent repair mission, as a result of direction from the district command.

Real emergencies should take precedence over training, and interrupt the training process. But, these should be infrequent events, which have a minimal impact on training over the long term.

Most students interviewed noted they had interruptions when training at the duty station. Several students stated that they went home to train, primarily to avoid the continuing interruptions. Some students stated that interruptions were minor; these were in a more-controlled training environment.

Most persons felt that, although interruptions are a potential problem, they can be adequately dealt with.

5.3.2 Time Problem

The time available for training was considered by the students to present a potential problem. At least one student, apparently, was told to train on his own time. This approach, obviously, will not work if a substantial training load is transferred to duty stations.

Most units are busy, using all available personnel to perform required work. Training, almost always, is viewed as a secondary activity, one that can be easily postponed to a less demanding time period. Although this approach may work in today's context, in which students are removed from their duty stations to training centers for serious training, it will not work when a large amount of necessary training is conducted at the duty stations.

The supervisory and command personnel generally felt that the time available for training, although a potential problem since operational needs almost always take precedent over training needs, can be effectively managed. Their primary rationale was that nonresident CBT should provide a net gain to the unit, of available personnel work hours. That is, the bottom-line of nonresident CBT should be less student training hours, and more personnel work hours. This was viewed as a benefit of the travel time savings, and the typical training time reduction associated with CBT courses.

5.3.3 Training Surroundings Problem

The training surroundings are comprised of the location in which the duty station training would take place, such as an office or a compartment on a cutter. They involve the physical space, as well as other aspects of the surroundings, such as noise and vibration. The surroundings can be conducive, or disruptive, to training. The interruption problem identified above, for example, can be greatly affected by the chosen training location. The interruptions cited by the interviewed students were largely due to the location chosen for their training.

The shore units have some potential surroundings problems. They are generally associated with disruptive noise from nearby machines and activities (e.g., hammering, noisy machinery), and people talking. These problems, although potentially great, should be relatively easy to solve, such as by locating students in an appropriate office space. Some persons indicated their unit had appropriate spaces to accommodate students, while others said they were short on space. At least two of the AN/WSC-3 CBT students were initially positioned in a machinery shop area for the training, alongside other workers performing normal maintenance work. This location was not appropriate for training, due to the many on-going distractions.

The shipboard duty stations have more severe potential environment problems, such as:

- **Noise**. Including distractions from normal work noises (e.g., machinery, repair activities), the ship's public address system announcements, fire drills, and man overboard drills. The impact of noise would vary considerably, depending on its characteristics (e.g., intensity).
- **Heat**
- **Vibration**
- **Ship motion**. This was stated as a potential problem on smaller vessels during normal seas, depending on the vessel's size. It was generally not viewed as a problem for larger vessels, even in moderate seas. Nor was it viewed as a problem when tied up alongside a pier.
- **Ship power surges**. These, which may occur often, could interrupt the training (e.g., lighting fluctuations).

5.3.4 Potential Solutions to Training Environment Problems

The training environment problems identified previously, can be solved by careful selection of the training location space, and strict management of training time.

5.3.4.1 Training Space

A training space should be provided for each student that eliminates the surroundings problems, and also reduces the potential for student interruptions. The availability of such spaces should be addressed centrally within the USCG, to identify appropriate solutions for every type of duty station (e.g., vessel, Headquarters). The training space should provide surroundings conducive to training, such as a quiet space with appropriate lighting, air conditioning and heating, necessary electrical outlets, and with sufficient table-top space. The space should be isolated from incidental interruptions, such as nearby noise and public address announcements. The ability to meet these requirements will differ across duty stations, and hence the particular solutions should be left to the local command's discretion. Several suggestions for appropriate training space were:

- **Away from the duty station**. Training may be conducted away from the duty station to eliminate, or reduce, student interruptions. The rationale suggests that if the student is not nearby the unit, the student cannot be interrupted or seized for other activities.

- **Available offices of support unit**. Support units generally have office space available for training. These spaces would usually satisfy the general environment issues, with the possible exception of interruptions and available time, which require management.
- **Pierside office**, for ships. This, of course, requires available office space pierside. Ship personnel could use, for example, available office and training facilities at support units. Each of the two Electronic Support Units (ESU) interviewed had appropriate space that could be used for duty station training, including a training laboratory with multimedia desktop computers.
- **Nearby support unit**, for ships. This would be similar to the pierside office addressed, but may require some travel by the student. If the travel was substantial (i.e., more than 30 minutes), this solution may affect the training strategy. Many support units, according to one person interviewed, are within a four-hour drive of duty stations; while, some require up to an eight-hour drive.
- **Quiet space onboard**. Suggestions given for appropriate spaces on board differed for the different ships. The general opinion was that appropriate training spaces would be more difficult to locate on small ships, in comparison with larger ships, but they could often be arranged. Suggestions included:

    - Radio room
    - Officer's office and stateroom
    - Messroom
    - Lounge
    - Student's shop
    - Other ship offices and spaces that can be made available.

- **Learning center at each unit**. The learning center would require providing a dedicated space at each unit, for the sole purpose of training (Note, the space could be shared with other functions, which would require some compromise). A dedicated space could more easily furnish necessary environment characteristics, and be amenable to firm control. This suggestion would be most difficult on ships, especially the smaller ships, due to space limitations.
- **Student's home**. This suggestion was viewed positively by all persons, as a means of greatly reducing interruptions and achieving a good training environment. Training at home, however, would not be an effective option for all students. Furthermore, this policy would require portable laptop computers, rather than desktop, for CBT courses. This policy would also place an administrative burden on the local unit, for keeping track of personnel and training materials (but, perhaps no more than some of the other options). Nevertheless, it is a potentially good alternative for many students.
- **Local library**. This would be similar to the student training at home, minus family related disruptions.

5.3.4.2 Training Time Management

An appropriate training space that provides a physical barrier to contact by others, such as training at home, would certainly assist in solving the training interruption problem. However, the problem of training time management would still remain. It, and the available time problem,

requires personnel time management actions to solve. For nonresident CBT to succeed, duty station training activities must be treated like any other work task. They must be scheduled in advance, and conducted on a regular basis, integrated with the normal duty station work tasks. Furthermore, training tasks, like other work tasks, have certain associated conditions that must be met, such as no interruptions. Management should be responsible for creating and maintaining an appropriate training environment.

Most persons interviewed stated that the management of training time at duty stations should not be a problem. But, they also stated that appropriate procedures and guidance must be effected to assure that an environment conducive to training is established and maintained at duty stations. Furthermore, their suggestions pertained to the complete Coast Guard command structure, from Headquarters to Districts, to duty stations, and finally to supervisors at the unit:

- **Schedule training like any other work task.**
  - Schedule all time blocks for a CBT course prior to the start of the course, like scheduling for a long-term project.
  - Provide strict controls on the scheduling and conduct of training.
  - Enforce the training schedule. Do not permit changes, except for real emergencies.
- **Training Time Periods.** Appropriate times should be scheduled for training during the work day. Students should not be expected to train in their spare time, or on their own time. The student must be given the necessary amount of time during normal work hours to achieve the requisite training. This should generally result in much less student time than equivalent instructor-led resident training, providing a net gain in available work time for the unit. Certain time periods may be particularly conducive to training at individual duty stations. These should be taken advantage of. For example, several suggestions were:

  - Any reasonable block of time during the work day (e.g., 2-hour block), scheduled in accordance with other tasks
  - Slack periods during extended deployments
  - Slack periods during long transits
  - While on standby duty in port

  Several persons suggested that the staff of a duty station should receive some of the benefit achieved by the reduction in overall training time resulting from training at the duty station (e.g., if bottom-line time savings accrue to the unit as a result of substantial nonresident CBT, then the unit staff should realize a corresponding workload reduction). This assumes that the unit workload would not increase in direct response to the nonresident CBT time savings.
- **Do not permit interruptions of students while training.** Allow interruption of students only for real emergencies.
- **Establish firm policies for conduct of duty station training.** The policies should:

  - Apply at all levels within the USCG, including Headquarters directorates, Districts and duty stations.
  - Create an environment at duty stations conducive to training.

- Prevent individuals or commands from circumventing the required duty station training policies. That is, the policies should define the requirements for conduct of training at duty stations, and should insulate the duty station from interference in meeting those requirements.
- Provide flexibility to the duty station for configuring and controlling their training process, in accordance with their needs. That is, the established policies should specify requirements to assure effective training, but also allow for local flexibility in meeting the requirements. Local unit flexibility in achieving their training needs is a major factor in support of nonresident CBT.
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- **Top down support for training policies**. Firm support for nonresident CBT must be given, and demonstrated, across the USCG. This support should be interjected into USCG management preparation activities (e.g., Prospective Commanding Officer Course), and actively marketed. It should be reflected in command directives at all levels.

5.4 STUDENT MOTIVATION

It is estimated, based on the interviews, that approximately half the students will prefer nonresident CBT to traditional instructor-led resident training. Reasons for preferring nonresident CBT were given earlier (Section 5.1, Overall Opinion of Nonresident Training). Reasons for preferring instructor-led resident training varied, some of which have been mentioned throughout this section. Generally, resident training would be preferred as a break from the daily work routine, and for the opportunity to travel. Another important reason cited was the training methodology, which included the individual's learning style and dislike for computers (e.g., dislike or unfamiliarity). Regardless of the reasons, a student motivation problem should be expected to accompany nonresident CBT, potentially affecting many students to varying degrees. Included in this problem should be those students who may prefer nonresident CBT, but who would have a motivation problem for other reasons.

The challenge facing the Coast Guard training community is how to motivate all students to train effectively and efficiently when in a self-paced nonresident course. An instructor, who normally deals with this problem, would not be present. The several suggestions were:

- **Training facilitator**. Have a duty station facilitator oversee and interact with each student. The facilitator would be tasked with motivating the student. The facilitator is addressed in more detail later in this section (Section 5.7.3, Facilitator).
- **Supervisor responsibility**. The student's immediate supervisor would be responsible to motivate the student to perform well in the course, similar to the supervisor's responsibility in overseeing the student's work. Some persons suggested that student motivation be left to the unit, which is similar to placing that responsibility with the student's immediate supervisor.
- **Provide incentives to the student**. Incentives were suggested for student performance, including proficiency (learning and test performance) and efficiency (course completion time), as follows:

- **Time off**. If the student finishes the course in less time than planned, with acceptable proficiency, the student would be given time off in proportion to the training time saved. The student could be given all of the time saved, or a portion of the time saved (e.g., 50%, on the basis of 50/50 sharing with the unit). If shared, the time savings could have motivational benefits across the unit, since other staff would benefit by having the student available for more work as a result of early course completion.
- **Course grade**. The awarding of a course grade was suggested as having real incentive value in motivating students to perform well.
- **Notations of course grade and completion time**, to be placed in the student's personnel file and on a course completion certificate.
- **Proficiency pay**. This would be a financial incentive for the course grade and the course completion time. It could be a one-time bonus paid at the completion of the course, similar to the tuition reimbursement policy of some companies (i.e., 100% reimbursement for an A, 75% for a B, 50% for a C, and 0% for a D or F).

5.5 TRAINING PROCESS

Potential problems were identified, and suggestions provided, for several topics relating to the training process. The suggestions provide guidance for the conduct of training, which is an essential part of a nonresident implementation plan.

5.5.1 Training Session

5.5.1.1 Daily Training Session

A typical CBT course would provide hours of training to a student, achieved during multiple training sessions spread over a series of days. The training sessions would be interspersed with work at the unit, during the typical workday. This approach would achieve distributed training, which is preferable to condensed training (i.e., in which the student engages only in training activities until the CBT course is completed). Suggestions for the training sessions are:

- **Maximum training session length of four hours; two hours preferred**. If the student trained for 1 to 2 hours a day, substantial time would be available for daily work tasks. The training session length (maximum and minimum) should be keyed to the training material, such that the student would stop at a logical stopping point, rather than simply a time point. If the training session is expected to extend for several hours, then breaks should be provided approximately every hour. The breaks should coincide with logical pause-points in the course (e.g., after completion of a problem).
- **Minimum training session length of 1 hour**. (See previous discussion)
- **Scheduling of training periods left to discretion of duty station**. The morning hours were generally preferred for training, although any time of day is acceptable. Scheduling of training was suggested on a case-by-case basis, as well as simultaneously for the whole unit or groups of staff (e.g., a block of time when most staff, or a group, would be engaged in training).

- **Multiple training sessions could be conducted** each day for a student, such as early morning and mid afternoon. They should be separated by substantial time (e.g., several hours), and have a short-to-medium length (e.g., no more than 2 hours).

5.5.1.2 Course Length

The length of a CBT course will depend on the training objectives, training strategy, and other factors. Resident courses of varying lengths may be converted to a nonresident CBT form, in whole or part. Some of these may be quite long, currently requiring several weeks of training. Since the training is expected to be conducted in a distributed manner at the duty station, as discussed previously, long courses may be difficult to administer. For example, a 20-hour CBT course may require two weeks to administer (two-hour sessions, five days a week). A 40-hour course similarly conducted might require about a month to complete.

A range of opinions was given for the maximum length of a CBT course to be conducted at duty stations, from 16 to 40 hours. Since a major advantage of CBT is its allowance of self-paced training, a nominal 40-hour course may take some students much longer to complete; or, it may be completed in less time. Shorter completion times would not present a problem for the duty station. The longer completion times, however, would pose an administrative problem. Nonresident CBT course lengths should be limited to a reasonable average time. A course should not exceed 40-hours in length. And, a more reasonable maximum course length would be around 25 hours.

Course conversions (i.e., converting existing resident courses to nonresident CBT form) should aim for a reasonable CBT course length. This may necessitate dividing the original course into several shorter courses when converting to the nonresident CBT form. For example, a current six-week course may have to be converted into three or more CBT courses. This conversion issue may, therefore, affect the structure of course offerings in the USCG (e.g., one course converted into several shorter courses; course prerequisite issues; qualification and rating issues).

5.5.2 Student-Computer Interface

Although many USCG personnel are familiar with using computers, the level of computer proficiency is likely to vary widely. Furthermore, some persons will not be comfortable in training with computer media, as noted earlier (See Section 5.4, Student Motivation). Several of the implementation suggestions in other sections partially address this problem. Two additional suggestions were provided:

- **Develop and specify a common student-computer interface** for all USCG CBT courses. This interface should not be limiting to developers, but should provide fundamental standards that would result in a similar interface across courses. Its goal should be to achieve rapid student familiarity (e.g., recognition of response procedures, features and controls) when starting a new course. Since students would, presumably, take many nonresident CBT courses over their career, having the basic knowledge and skill set to immediately interact in an effective manner with a new course can have distinct efficiency, effectiveness and motivational benefits. The interface standard should not inhibit interface improvement. It should be linked with current commercial person-

computer interface standards, CBT course student interaction approaches (e.g., selection and operation of tools using a mouse; multiple choice question presentation; location of HELP function; window manipulation), and allowed to evolve along with the computer-training industry.

- **Develop a student training guide**. This guide would be specific to nonresident (e.g., CBT, IVT) training at duty stations. It would apply across the range of nonresident courses. It would provide both general training guidance, and serve as a handbook for the student interface with various training media, particularly the student-computer interface. This type of a guide is particularly important due to the level of responsibility the student bears for nonresident training (e.g., self paced; may be located remotely from the duty station).

5.5.3 Student Help

A drawback of nonresident training is the absence of an instructor to help the individual student when particular learning difficulties are encountered. Sources of technical assistance must be available to students for each nonresident course (i.e., this is in addition to general assistance, which would be provided by their unit; see Section 5.7.3, Facilitator). The following two suggestions were postulated as able to satisfy this problem.

- **Assistance from nearby senior persons**. Have nearby senior persons available to answer questions and provide clarification to students. Senior persons in the student's unit, if available, would be most appropriate. Many persons felt that senior persons on other nearby units could also provide this type of assistance, either by having the student go to the other unit, or by telephone. This type of assistance is familiar to most USCG units, in the form of on-the-job-training. This suggestion would expand that concept. It would require receptivity on the part of the senior persons, and their units. As with all of the suggestions in this report, to be effective, this type of assistance must be addressed in formal USCG policy.
- **Hotline to a Subject Matter Expert (SME)**. All persons felt that technical help could be provided to individual students through a telephone hotline. A hotline would be provided for each nonresident course. Ideally, the hotlines would be accessible 24 hours a day, although this may not be feasible. Internet and email access was suggested as alternatives. A combination of voice telephone, (e.g., certain hours of the day), email, and internet may provide a good mix of help. Note, cost and accessibility of communication links may be significant issues for some duty stations (e.g., vessels at sea). The MARSAT link was cited as expensive, and having a daily minutes-per-day access limit. Several persons also suggested integrating the training help hotline with an equipment support hotline.

5.5.4 Hands-On Training

Hands-on training may be an important part of certain nonresident courses. The necessity for a hands-on training course component, as well as its content, will depend on the particular course. It was considered important for the AN/WSC-3 CBT course, with a two-hour hands-on training module provided to all students. Its purpose in the AN/WSC-3 CBT course was to assist the

student in transitioning from the CBT medium to the actual hardware (e.g., familiarize the students with the AN/WSC-3 hardware; locate test points).

Most persons interviewed felt that hands-on training is necessary, and could be effectively conducted in the field, at an operational unit. Some suggested that this type of training at the field unit would have the added benefit of using equipment configured for operational use (i.e., rather than a generic configuration in a training lab). The hands-on training should be conducted in the presence of a senior staff member of the unit where the hardware is located, who would oversee the student's activities. The general opinion was that the senior individual need not be qualified in the student's area of training, although it would be advantageous.

All persons interviewed felt that hands-on training would be important for some courses, but not necessarily for all courses. Several issues addressed were:

In what courses is hands-on training necessary?
How much hands-on training is necessary?
What should be the content of the hands-on training?
Where, when and how should the hands-on training be conducted?

Courses Requiring Hands-On Training. Hands-on training was generally viewed as important for courses involving the training of manual skills (e.g., maintenance and operation courses), and not for knowledge-only courses (e.g., administration courses). Exercising was cited as important in this regard. It should be noted that findings from the student and facilitator questionnaires identified the need for more practice problems in the AN/WSC-3 CBT course, which equates to more exercising. Hence, part of the identified need for hands-on training may be satisfied by more exercising in the CBT media.

A nonresident training implementation plan should address the issue of which courses require a hands-on training component. The ensuing issues of the particular hands-on training course content, and the amount of such training, would also need to be determined for each course.

Amount of Hands-On Training. Although it was difficult for the interviewed persons to estimate the amount of hands-on training that would be required, due to the many different courses that may be possible, the 2-hours provided in the AN/WSC-3 CBT course was generally cited as a good role model. This means that the hands-on training may be brief for a maintenance and operations course.

Location and Timing of Hands-On Training. The location in which the hands-on training would be provided is a particularly difficult issue, and affects the timing and content of such training. If the appropriate hardware is available at the student's duty station, most persons felt that this would be the best place to conduct hands-on training. After completing the CBT part of the course, the student would then go through the hands-on part at the duty station during the next training session.

The difficulty arises when the required equipment is not located at the student's duty station, for example, if the student is being trained prior to transferring to the next duty station. The suggestions to address this problem were:

- **Delay the hands-on training part until the student reports to the next duty station**, which would have the necessary equipment. This was the solution favored by most persons. It is viable if the student will transfer shortly after completion of the CBT part of the course. If, on the other hand, months pass before the student transfers, retention of knowledge and skills may become a problem. Note, retention would usually be a problem when there is a delay between course completion and start of related work, whether or not hands-on training was accomplished. Hence, the delay may not have any greater adverse impact than that currently being experienced. Several persons noted that a student may have a difficult time taking an important CBT course shortly after arriving at a new duty station, because of the student's unfamiliarity with the unit, personal issues associated with the recent move, and other learning demands that may be placed on new personnel (e.g., damage control training).
- **Delay the CBT course until the student reports to the new duty station**. The course would then be taken at a duty station that has the necessary equipment for hands-on training. An indirect benefit of this alternative is that the student would be trained much nearer the time the knowledge and skills would be used. This alternative would necessitate re-structuring the relationship between training and transferring, as regards pipeline training. The person would report to the new duty station before receiving the requisite training. The transferring person may experience difficulty taking the course at the new duty station, as noted in the preceding suggestion.
- **Conduct the CBT course at a shore unit nearby the student's new duty station**. The student would transfer out of the current duty station to the unit nearby the new duty station, to participate in nonresident CBT. The nonresident CBT would be conducted at the shore unit (e.g., Engineering Support Unit). After completion of the training, the student would report to the new duty station, at which time the hands-on training would be conducted. If the appropriate equipment is available at the temporary shore unit, the hands-on training could be conducted at that location.
- **Shoreside support units could be equipped to provide the hands-on training** (As well as provide space for students to conduct the CBT course, as discussed above). Appropriate equipment would be necessary at the unit to conduct the hands-on training.
- **Have the hands-on training accomplished at a unit nearby the student's duty station**. Many persons, although not all, felt that this alternative would work. Those that did not believe this to be a viable alternative suggested that the unit with the equipment may be reluctant to allow an unknown person to work on their equipment. This attitude would likely exist in at least some situations, relegating this alternative to less feasible.
- **Let the student's unit decide** on how the required hands-on training will be achieved. This alternative was suggested by a number of persons, noting that several of the above alternatives are viable, and that the best will depend on the situation at the specific unit.

The bottom-line is that hands-on training is expected to be necessary for certain courses. The amount of hands-on training that is required should be relatively small for most courses (e.g., 1 or 2 hours for a course like the AN/WSC-3 CBT course), although not all courses. The required hands-on training can be achieved at a USCG unit. Several viable approaches are available for achieving the hands-on training. The approach used may have to be determined by the circumstances at the particular duty station.

Content of Hands-On Training. It was suggested that most of the training content in a course could be conducted in the CBT media, with the hands-on training focused on transition and validation of skills and knowledge. Suggestions for hands-on training content, in the context of maintenance training, were:

Preventive Maintenance Service (PMS)
Testing of boards
Alignments
Front panel controls
Location of test points and adjustment points

The conduct of hands-on training in the field raises the issue of the extent to which a student would be allowed to interact with operational equipment. Most persons felt that having the student operate and perform basic maintenance procedures (e.g., alignments) on operational equipment would be acceptable, especially since the student would have essentially completed the course prior to the hands-on part.

Different opinions were expressed on the viability of inserting faults into operational equipment for training or testing. Many, although not all, persons suggested that operational units would not allow faults to be inserted into their operating equipment. Several persons, on the other hand, suggested that insertion of faults would be viable at many units, especially if the fault insertion was accomplished by installing a faulty component (e.g., rigged board) that would not affect other components; and if the unit had multiple sets of the equipment (e.g., large cutters often have multiple AN/WSC-3 UHF transceivers).

Regardless of the hands-on training content, formal procedures are deemed necessary for the hands-on training associated with any course. The procedures would provide specific guidance to the student, as well as the senior person overseeing the hands-on training.

5.5.5 Student Input Characteristics

Instructors in resident courses often adapt at least part of their instruction to the characteristics of the students. Thus, although courses may have specified student input characteristics (i.e., prerequisite skills and knowledge) the range of skills and knowledge can vary widely across a class. CBT course adaptability to the student's entering proficiency, would be similar. However, high degrees of adaptability in CBT courses are expensive to develop. Consequently, most CBT courses are somewhat rigid, being developed for a specific level of student input characteristics. This is an important issue to consider in developing the nonresident structure of courses. Two alternative solutions were suggested.

- **Automatic Diagnostic Evaluation and Branching.** Build adaptability into the CBT course. This would require diagnostic evaluation of the student's relevant input characteristics at the start of the course, with automatic tailoring of the subsequent training to fit the student's profile. For example, the course might automatically determine which, if any, preliminary training modules should be conducted prior to the main course content, based on the diagnostic evaluation. It might also order the

presentation sequence of these preliminary training modules, as well as those of the main course. Finally, the course may automatically select or change the sequence of training modules at any time during the training, in correspondence with student performance. Diagnostic evaluation and branching of this type would allow a wider range of student input characteristics, but is more expensive to develop than a course based on one serial path through the modules.

- **Stringent Student Prerequisites**. The required student prerequisites for a nonresident course that is not adaptable should be stringent. Otherwise, student time may be wasted by engaging in a course for which the student does not possess the minimum skills and knowledge.

5.5.6 Testing

Testing is concerned with two issues: 1) testing as part of the training course, to assess student progress, and strengths and weaknesses; and 2) testing of the student pursuant to certification that the student has passed the course and is capable of proficient performance. Certification, and its associated testing, is addressed in the next section. Testing in support of the training process is addressed here.

Testing was an issue because much of the testing in resident-based operation and maintenance courses is accomplished with actual equipment in a lab. It was generally felt that testing in the computer-display medium, similar to the training and problem solving activities during the course, would be satisfactory.

If hands-on testing were necessary, the suggestions were for it to be integrated with the hands-on training. The problems associated with such hands-on testing would be similar to those discussed previously regarding hands-on training.

5.6 STUDENT CERTIFICATION

This is an important and diverse issue that must be carefully addressed in a nonresident training implementation plan, to assure that students meet acceptable proficiency standards. This issue also overlaps with the testing and hands-on training issues previously discussed.

5.6.1 Certification Authority

It was generally suggested that a central USCG authority (e.g., USCG Institute) issue the certification for each student, rather than the duty station. The certification, including the qualification code, would be issued after the student has completed the course and all requisite certification testing.

Additional suggestions for the certification authority included: 1) student's duty station commanding officer; 2) duty station's education officer or training officer; and 3) the course's Subject Matter Expert (SME) (i.e., who would be available through the student's help hotline).

5.6.2 Evaluation of Student Proficiency

Issues addressed with regard to student evaluation for certification were: 1) Need for student certification testing; 2) Certification test media; and 3) Location and administration of the certification testing.

Need for Student Certification Testing. Many of the duty station persons interviewed felt that some form of certification testing should be required, after the student completed the course. Usually this opinion was associated with the need to demonstrate proficiency on the actual hardware (i.e., hands-on testing). It was also suggested that this type of testing would be necessary at least during the early stages of widespread nonresident training, to demonstrate student proficiency to the units. Certification testing of each student could later be replaced with certification of the course (see next paragraph).

Some persons suggested that the student should be certified as a result of completing the course, and should not require a separate certification test. This approach would require certification of the course, rather than the students. All students who successfully complete the course would have passed the tests associated with the course, and therefore would have already demonstrated their proficiency. In essence, the certification test would be built into the course.

Certification Test Media. The typical certification test would have the student perform tasks similar to those required in the operational environment (e.g., troubleshooting the AN/WSC-3). Two basic types of test media were suggested: 1) computer media used during the course; and 2) actual equipment. Although more persons suggested testing on the actual equipment, a number of persons suggested that testing in the computer-based training media would be satisfactory.

It is recommended that the USCG consider development and empirical evaluation of computer-based tests for the initial courses converted to a nonresident form. This approach would serve to develop, evaluate and demonstrate the viability of computer-based testing in lieu of testing on the actual equipment (i.e., assuming that such testing would be valid and reliable). The initial students could be tested with both media, providing the basis for validity and reliability assessments.

Location and Administration of Certification Test. If the certification test is to be conducted using the computer-based media, it could take place in the training location. If, on the other hand, the certification test is to be conducted with actual hardware, the location issues discussed above regarding hands-on training apply (as do the alternative solutions). Note, the person(s) involved with administration of the certification test would not necessarily award the student certification, although they could (see the above discussion about certification authority).

A variety of suggestions were made for how the certification testing should be administered:

- **Remote link with an SME**. This approach received support by all of the persons interviewed. The test could use either the computer-based or actual equipment media, with the student performing activities directed by the SME. The student would be connected by telephone or internet to the remotely-located SME, who would direct the

test, evaluate the results, and pass or fail the student. A senior person (e.g., training officer) would be with the student during all parts of the test, to oversee the student's activities and provide a local control person for the SME. The test would be performed in an appropriate office or space, depending on the test media (i.e., actual hardware or computer-based) and other factors addressed earlier.

- **Support unit (or detachment) staff.** An appropriately qualified individual at a nearby support unit could administer the test and certify the student. This could be accomplished at the student's duty station, or the support unit location.
- **Student supervisor or other senior qualified person at the duty station.** Depending on the test, the administrator may or may not have to be qualified in the subject matter.
- **Other suggestions** were:
  - Commanding officer of the duty station
  - Education officer, or training officer at the duty station
  - Qualified senior person from a nearby unit
  - Contractor support team working in the area. If they are not permanently assigned to the area, then testing would be scheduled with their visit to the area.
  - USCG support team working in the area.

Whoever the test administrator is, that person should be qualified to administer the test (i.e., have special training and preparation, the extent of which will depend on the test requirements).

The above suggestions that would be under control of the duty station would provide them the greatest flexibility for training, testing and certifying their personnel. Other solutions would require careful scheduling of the testing, with less flexibility for the duty station.

5.7 NONRESIDENT TRAINING MANAGEMENT

Training management includes issues of central versus local control (e.g., storage and distribution of training materials), and the local daily management of training activities at the duty station.

5.7.1 Duty Station and Central Control Issues

Field units, today, have little control over when a course is taught, and must adapt their activities to the course schedule if they want a student to receive the training. With nonresident training, since the course would be taught at the unit (or at least nearby), and since the training materials could be made available to every unit, the duty station could control the course schedule. Along with this increased flexibility at duty stations resulting from nonresident training, would be increased tasking and responsibility to administer the associated training functions.

A perceived major strength of nonresident training, as noted earlier, would be the ability of the unit to conduct particular courses when convenient, and to have their personnel trained in the skills they deem necessary. The unit would not be affected by limited course quotas, or an incompatible course schedule. Furthermore, they could achieve a greater degree of cross training to assist with anticipated workload demands. Consequently, persons interviewed strongly urged that these aspects of nonresident training be placed under the control of the duty station, namely, who to train, what to train, and when to train.

Most persons recognized a need for some degree of central control. This was suggested to take the form of guidance on how to conduct training at the duty station, including general guidance and course-specific guidance. The differences between duty stations were suggested to necessitate differing levels of central and local control, with a general conclusion that a mix of control would be desirable, which could be determined by each duty station. The issues and suggestions in this regard pertain to:

- Management of training course materials
- Training and testing control
- USCG Institute

Management of Training Course Materials. This includes storage and distribution of training media (including hardware), and configuration management. Mixed opinions were received for the following:

- **Central USCG storage and distribution of all training media**. When a duty station wants a person trained, the course would be ordered from the central repository, and immediately shipped to the unit. This turn around time should be brief, perhaps a couple of days. The central repository would, thus, be saddled with the material management function. At one extreme, the central repository would supply all materials, including hardware, software, and other materials (e.g., technical manuals). At the other extreme, the central repository would manage only the software and specific training manuals, but not operation or technical manuals. A small cutter may prefer this alternative, with a small local administrative and storage burden.
- **Complete library of USCG CBT courses at each duty station**. Generally, this would consist of a library of compact disks (CD's). When a duty station wants a person trained, the training supervisor would get the course CD from the library and initiate the training. This approach necessitates that all training materials to be on the course CD. Hardware and other operational materials would also have to be resident at the duty station, or obtained separately. The duty station would be tasked with configuration control of its course CD inventory (e.g., Make sure its courses are the latest versions). A large cutter that often goes on extended deployments would likely prefer this alternative, since unanticipated training needs could be met while deployed.
- **Mixed approach**, in which the central repository functions as suggested above for course CD's, and in which each duty station can maintain a library of course CD's as desired. The duty station would keep CD's for their high-use courses, and request others from the central repository. Navy vessels, at least some, use this approach. A copy of relevant courses is kept in the onboard library, for which the training officer is responsible.

Each of the above alternatives has administrative burdens for the duty station. The central repository would likely have the smallest burden, but would also be the least flexible for the duty station. The preferences for the first two alternatives were split between persons interviewed. On the other hand, most persons felt the mixed alternative would be satisfactory.

Training and Testing Control. Several issues were addressed regarding the types of central controls that should be applied to the duty station training process, with the following suggestions:

- **Course offerings**. Scheduling of courses should be at the discretion of the duty station.
- **Training process**. Guidance should be provided to duty stations, both general for all courses, and specific with each course (when necessary). For example, the guidance should suggest training session length.
- **Course completion schedule**. The maximum time period in which the course must be completed should be specified, and controlled, by a central authority. Hence, if the duty station initiates a course, it must be required to notify the central authority.
- **Coordination of training across the USCG** must be tracked and controlled by a central authority. This would include monitoring of duty station training activities, and individual student training records. Regular reporting of training activities by duty stations would be required. Software at the duty station, to assist this process, should be provided.
- **Certification testing should be controlled by this same central authority**. This includes oversight of the testing schedule, and determination of results. Test results should be transmitted to the relevant parties after the results have been calculated (e.g., student, training officer, central student records). The qualification codes would be issued by this central authority. Note, certification issues have been discussed previously.

USCG Institute. The career training courses currently administered by the USCG Institute were often cited as a good example of nonresident training. This type of training has a mix of local and central control. A somewhat similar mix of control was suggested by a number of persons, going so far as to suggest that the USCG Institute administer all nonresident courses.

5.7.2 Local Training Management

Each duty station should have one, and perhaps two, training managers. If two, their functions should be:

- **Unit Training Manager**. This is a management function, concerned with the management of all training activities at the duty station, which may be considerable if nonresident training is implemented on a large-scale. Examples are:

  - Coordinate and schedule all unit training. This would require coordination with persons within the duty station, such as the students' immediate supervisors. It would involve scheduling courses, training materials, and training spaces.
  - Coordinate all unit training personnel and tasking. This would involve coordination of persons involved with training activities, such as the facilitator and others providing assistance.
  - Administer training tests, as required.
  - Oversee student certification activities.

- Administer unit training records. This would include management of the unit's training materials library and hardware (e.g., training computers), unit records and student records.
- Provide the primary interface with the central training authority. This may involve requesting course materials, coordination of testing and certification, and transmittal of unit and individual student records.

- **Training Facilitator**. This function, for which multiple people may required, would involve overseeing the detailed training activities of one or more students. Issues related to the facilitator are addressed in the next subsection.

5.7.3 Facilitator

A training facilitator is deemed necessary to work with each student during a nonresident course. The facilitator's function would not be to train, but rather to assist the student with arrangements and problems, to provide general guidance, and to monitor the student's progress. Generally, the facilitator would not be expected to spend a lot of time with a student, but would conduct at least daily monitoring of the student's training progress. All persons interviewed indicated the importance of having a facilitator at each duty station, who will interact with each student. Several suggestions in this regard:

- **Who**. The facilitator may be the student's immediate supervisor, or an appropriate person senior to the student.
- **Facilitator's tasks**:
  - Assist the Training Manager with arrangements for the student, such as designating the training space, scheduling the training session time blocks, and making arrangements for special course requirements (e.g., hands-on training). Over the long term, if nonresident training is conducted on a large-scale, many of these tasks should become routine at each duty station (e.g., designating the training location).
  - Guide the student, as necessary. For example, the facilitator would provide guidance for new staff members with regard to the unit's normal training practices and procedures. Guidance might also be provided with regard to special course requirements, such as hands-on training.
  - Monitor the student's progress daily to identify and solve training process problems.
  - Oversee the training materials used by the student. These could include course software, manuals, a computer, and test materials.
- **Number of facilitators needed at a duty station** will depend on the number of students being trained, the amount of facilitator involvement for a particular course and student, ongoing operations at the unit, and other factors. The facilitator function may be part-time, or full-time, depending on the student load. As noted above, the facilitator should not be expected to spend a lot of time with the student each day, perhaps as little as five minutes per day to monitor progress. The time demand, however, would increase with the occurrence of certain events, such as student problems or the need for testing assistance.
- **Software tools** should be provided to assist the facilitator in monitoring student progress. The tools should provide a quick summary to the facilitator upon request, indicative of

student progress and alertment of particular learning difficulties. These are addressed further in the next subsection.

- **Formal training** should be given to prepare the facilitator for this important function.

5.8 DUTY STATION SUPPORT

This subsection discusses suggestions for support to be given to duty stations.

5.8.1 Nonresident Training Guidelines

USCG personnel at all levels will be faced with a major change in responsibilities if nonresident training is implemented on a large-scale (i.e., a large number of nonresident courses distributed USCG wide). Although some training has always occurred at duty stations, the major responsibility for formal training has resided with USCG training organizations. Large-scale nonresident training will shift a substantial portion of this responsibility to units, and to individuals within those units, including the students themselves. Guidance is required at all levels within the USCG to assure the development and execution of an effective nonresident training program. The guidelines would represent the USCG's policies for the conduct of nonresident training, and assist their implementation with general and specific guidance. At least three levels of guidelines are suggested, as discussed below.

Student Training Guide. A student training guide was suggested earlier (See Section 5.5.2, Student-Computer Interface). This would be generic, and help to guide the student in the conduct of nonresident training. Course-specific guidance material should also be provided, accompanying each course.

Duty Station Training Guidelines. Detailed guidance, on the establishment and conduct of effective training practices and procedures, should be developed and provided to each duty station. These were considered very important by many of the interviewed staff, for the establishment of an effective training process at duty stations. The guidelines' content should address the range of issues affecting the implementation and conduct of training, including:

- Nonresident training goals at duty stations.
- Requirements for the conduct of training at duty stations.
- Types of training to be conducted at duty stations, and considerations for their achievement (e.g., options for achieving hands-on training).
- How to establish an effective training structure at a duty station, tailored for the major types of duty stations. How to integrate training with other tasks and activities, including prioritization and management.
- How to conduct training at duty stations, including formal procedures for the training process (e.g., training environment characteristics, training session length, facilitator tasks).
- Student monitoring and management.
- Testing and certification.

- Good training practices.
- Coordination with the District and other Coast Guard training organizations.
- Applied examples.

District Guidelines. Guidelines should be developed for USCG districts, who will also have a training management role due to the interaction of training and operations tasks. These guidelines should be similar to those for the duty stations, but addressing the issues from the district perspective. Importantly, these guidelines should make commanders aware of the volume of training that must be conducted, and the requirements of a duty station environment conducive to training.

5.8.2 Software Management Tools

The amount of coordination to be required for large-scale nonresident training is expected to be greater than that required under the current resident training system, due to the distributed manner in which training would be conducted. This is expected to place a greater monitoring and coordination burden on the duty stations.

A set of software tools should be developed to assist the management of training at duty stations. These tools would assist with the local training activities, and with coordination between the duty station and other USCG training and management organizations. Examples of support:

- **Configuration management** of training and testing materials at the duty station, including courses, manuals and hardware.
- **Management bookkeeping** for all training and testing materials at the duty station.
- **Catalogue** of all courses and materials available for nonresident training. This should include description of the training and certification process, and materials associated with each course.
- **Electronic ordering** of courses and associated materials.
- **Student training progress monitoring** (See Section 5.7.3, Facilitator). This should include a simple quick-look information screen that can be accessed by the facilitator, to obtain an immediate summary of the student's training progress in the particular course. A basic-level automatic diagnostic capability should obtain the relevant student course progress data, and assemble the summary screen with information that will alert the facilitator to student difficulties. Note, this capability would require a computer-based course, and the student to be connected to a local network (e.g., if training at home on a laptop computer, automatic monitoring may not be feasible).
- **Special assistance with training and certification activities**, such as the previously suggested communication link with an SME to conduct a student certification test. Special tools may, or may not be required for these activities.
- **Maintenance of duty station and student training records**.
- **Support of administrative and management coordination** with USCG training organizations external to the duty station, including Group and District commands, as necessary. These tools would collect, assemble and transmit status information and reports, as required. They are particularly important to reduce the duty station

administrative load that will be required to support the central monitoring of training activities (e.g., courses conducted, certifications awarded, personnel advancement records).

- **Support of other training activities** at the duty station.

5.9 COMMAND SUPPORT

A particularly important issue identified by most persons interviewed is the need for command buy-in of nonresident training, meaning command at all levels within the USCG, from the admiral-level to the duty station commander. The commands are viewed as focused on their primary operational mission goals, which for field units usually does not include training. Although it was felt that commands view training as important, they also view operational needs as taking priority over training needs at the field units. Although this is certainly a reasonable view, since training seldom has critical immediate needs and can easily be postponed to a more convenient time, it takes place in a system largely dependent on resident-based training for development of critical skills and knowledge. If a large-scale conversion to nonresident training is implemented, operations practices that are disruptive to the training process at duty stations (i.e., which are common today) may have a substantial adverse impact on the effectiveness and efficiency of nonresident training. And, in turn, these practices may have a similar adverse impact on the long term operational proficiency of units.

As suggested earlier, for nonresident training to succeed, the "training task" must be elevated to a level roughly equivalent to other operational tasks in the view of commands, and scheduled accordingly. The requisite training must be conducted in a duty station environment that is conducive to effective training. The persons interviewed generally felt that command buy-in at all levels would be necessary to assure proper emphasis is given to the training process at duty stations. As one person stated, a philosophical culture change within the USCG will be necessary to achieve an environment at duty stations that will facilitate training.

Several suggestions to achieve command support were:

- **Nonresident training guidelines**, as suggested above.
- **Strong emphasis on the need for good training practices from all levels of the USCG (e.g., Headquarters).**
- **Insert a major module in the PCO/PXO course** addressing nonresident training. This module should focus on the importance of nonresident training, characteristics of a duty station environment conducive to training, and how to manage and conduct nonresident training.
- **Assurances that effective training can be achieved at duty stations**, if the appropriate training practices are implemented.
- **Formal internal USCG marketing effort** should be developed for nonresident training, to generate support. This marketing should be specifically aimed at commanders, at all levels. The reasoning was that, if the commander supports nonresident training, the staff will also.

- **Student critique administered after every course**, containing questions about command support and training practices. This would provide early detection of problems, and enable timely corrective action.

5.10 HARDWARE ISSUES

The hardware issues addressed during the interviews focused on CBT, similar to the AN/WSC-3 CBT course. The issues and suggestions are discussed in this subsection.

5.10.1 Local Versus Central Control of Training Computers

This issue is relevant only if laptop computers are used for training. Local control of computers would involve providing a set of training computers to all duty stations, for the primary purpose of conducting nonresident training. The advantage of local control would be having hardware always available for training. The time delays, cost and other requirements associated with shipping computers from a central repository would not be required, resulting in a cost savings. On the other hand, local control would require hardware management tasks, such as accountability and repair. Most persons preferred having local control.

Central control of computers would compliment a central repository for distribution of the complete course package to each student, at the time the course is to be conducted (See Section 5.7.1, Duty Station and Central Control Issues). For example, the course could be distributed pre-installed on the laptop computer, similar to the procedure used for the AN/WSC-3 CBT course. This approach would be expected to reduce the administrative load at duty stations, but also reduce their flexibility. Its cost would likely be higher, due to shipping (i.e., shipping costs, packaging, breakage, inventory). Central control was generally considered acceptable, although not preferred, by most persons. Some individuals, however, did prefer this approach, citing less administrative work for smaller units.

5.10.2 Laptop Versus Desktop Computers

This issue would be relevant only if the training computers were permanently located at the duty stations, since continually shipping desktop computers would not be a viable option. Some individuals preferred laptops, while others preferred desktops. The issues were:

- **Laptop**. Flexibility was cited as the primary advantage, enabling the student to go to a desired training location with the computer (e.g., home, vacant office at the unit, office on the pier, radio room for certification testing). Survivability was also cited, although this may not be accurate if desktop computers were not moved. On the other hand, a laptop would be much more susceptible to pilfering (pilfering of laptop computers was noted as a problem on two U.S. Navy ships visited by project team members). And, the cost of appropriately configured laptop computers would likely be greater than equivalent desktop computers.
- **Desktop**. Computer system robustness was cited as the primary advantage. This included suggestions that the person-computer interface (e.g., larger display, mouse) may be better for long courses and detailed manual manipulations, and have greater compatibility with other hardware and software. Pilfering would be a minor issue. The

primary disadvantage cited was inflexibility for remote training (e.g., training at home). The greater space requirement for desktop computers was also noted as a disadvantage.

Laptop computers appear preferable to desktop computers, on the basis of some of the implementation suggestions, such as allowing flexibility with the student's training location,. Perhaps the best approach would be to use a mix of laptop and desktop computers at each unit.

5.10.3 Use of Operational Workstations for Training

The anticipated availability of USCG Standard Workstation III (CGSWIII) computers at duty stations was expected to vary, with some units receiving a relatively large number and others receiving few. The supervisory persons interviewed indicated that it would be feasible to use their CGSWIII computers for training, but on a part-time basis only. Consequently, it was also suggested that the operational workstations would have to be augmented by training computers to address large-scale nonresident CBT, due to insufficient numbers of CGSWIII computers to support all likely training needs. Nonresident CBT, therefore, would be conducted using a mix of operational computers and dedicated training computers. Consequently, it was suggested that some number of training computers would have to be purchased for each duty station to support nonresident CBT.

The computer systems used for CBT would likely require a multimedia configuration. Although most units had, or expected to receive, some multimedia computers, not all of CGSWIII computers were so configured at the time interviewed. This would place additional constraints on the availability of operational computers for training duty.

5.11 QUALITY ASSURANCE

Large-scale nonresident training will require a greater degree of quality assurance than resident training, due to the much wider dispersion of training responsibility. Persons interviewed generally felt that the USCG will need some amount of centralized control on the training process conducted at duty stations, although they cautioned against reducing the inherent flexibility of nonresident training at duty stations. The control suggested was:

- **Provide guidance** for the establishment and conduct of an effective training process at duty stations, but allow flexibility. This has been discussed in several of the preceding sections.
- **Provide centralized monitoring of nonresident training** to assure that the training is being properly conducted, and to identify problem areas for early corrective action. This may include sampling the training effectiveness of nonresident courses, by empirically evaluating selected courses each year. Several related suggestions were made earlier, such as a student questionnaire after completion of every course.
- **Proactively evaluate a subset of courses each year to determine if they require upgrading**. Resident courses are regularly improved by their instructors, as operational practices and requirements change, and as improved training strategies become available. Over several years, such evolutionary changes can be substantial. A CBT course, on the other hand, will not change unless there is proactive intervention. To maintain an

effective nonresident training program, courses must be periodically evaluated, and changed when necessary.

5.12 OTHER NONRESIDENT TRAINING ISSUES

Several additional issues indirectly related to nonresident training are discussed in this subsection.

5.12.1 Other Electronic Media Concepts for Duty Stations

Opinions were solicited regarding electronic technical manuals and just-in-time training (i.e., training provided in CBT form, in association with an electronic tech manual, at the time a particular non-critical task is to be performed on the job). All persons were supportive of both concepts.

5.12.2 Classified Materials

Only some of the duty stations visited were capable of storing classified materials. The persons in those units indicated that the handling and storage of classified materials for training would not present any new problems, as long as the training that accessed classified material was conducted on the premises. Such training would not be feasible at a non-cleared site, such as the student's home, a potential limitation.

An additional problem arises if the classified material is computer-based. A classified computer would be required in addition to a cleared space for conduct of the training.

5.12.3 Pipeline Training

Many individuals are not pleased with the way pipeline training is conducted today, in which a student is sent to a course in preparation for the next duty station, while still assigned to the current duty station. They felt this places added burdens on the student's current duty station. With this situation in mind, considering the time savings often associated with CBT courses, and the nearby partial availability of a student engaged in training at the duty station, all persons favored nonresident courses for satisfying pipeline training requirements. In fact, a number of persons suggested that nonresident training could be a key partial solution to the "pipeline training problem."

Some potential problems associated with nonresident courses for pipeline training were noted earlier, particularly in regard to achieving necessary hands-on training (See Section 5.5.4, Hands-On Training).

Several of the persons interviewed felt that pipeline training would be better provided at the student's new duty station, or during the period of transition between duty stations.

5.12.4 Minimum Crewing

Opinions were received both for and against minimum crewing. On the other hand, everyone spoken with about this issue gave the opinion that nonresident training will be a definite benefit to minimum-crewed vessels. The two basic reasons were:

- **Overall time savings to the crew**, due to the typically reduced training time associated with CBT courses. This would translate into the student being available for more work, and a correspondingly smaller burden for the rest of the crew.
- **Nearby availability of the student** during the period of training (i.e., either at the duty station, at home, or elsewhere nearby). The student would be available to assist in case of an emergency.

5.12.5 Learning Centers

Learning centers could be provided shoreside, near many operating units, to furnish appropriate training spaces. The learning centers would consist of one or more rooms devoted to training. The rooms could have computers, or just table-top space. They would be available for training students from any unit. Each of the two Engineering Support Units visited had a room with desktop computers, devoted to training.

A similar learning center space could be designated at each shoreside duty station, in accordance with the unit's size and other factors. The learning center would facilitate nonresident CBT by reducing problems associated with the training environment. Cost would be the primary concern. The learning center was also discussed earlier, in Section 5.3.4, Potential Solutions to Training Environment Problems.

Mixed views were obtained about locating a learning center shipboard. Many people felt it was feasible on larger cutters, especially if nonresident CBT was to be implemented on a large scale. The space limitations on smaller vessels may prohibit this type of space. One suggestion was to make the messroom multi-purpose, by fitting computers into the tables. It could then serve as a learning center part-time. The navy has learning resource centers on some ships, and at shore bases. On the two U.S. Navy ships visited by project team members, the learning resource center was used primarily for morale purposes (e.g., email link to family, entertainment). The CBT courses that were conducted on that ship, were done so on the computers in the various workspaces.

5.13 CONVERSION TO NONRESIDENT TRAINING

This section addresses the conversion of course to a nonresident training basis, and discusses the need for a nonresident training implementation plan.

5.13.1 Course Conversions

A variety of suggestions were received for courses that would be good candidates for conversion to nonresident training. In addition, the suggestion was made by several persons that much of the

current nonresident training should be converted to CBT courses. This suggestion included correspondence courses, and general safety and other qualification training received when reporting to a new duty station. The suggestions were:

- Unit training, such as shipboard qualifications, and unit safety qualifications.
- All correspondence courses. Personal advancement courses.
- All short courses.
- Most C-Schools.
- General shop skills and knowledge.
- All equipment at the duty station.
- Pipeline training.
- Administrative processes.
- Divisional and operational processes at the unit, such as:
  - Piloting and navigation
  - Communications, radio telephone
  - Getting underway
  - Watchstanding
  - Rules of the Road
  - Buoy deck
  - Signaling
- Specific equipment or course:
  - Global Positioning System (GPS) receivers, transceivers
  - Loud hailer
  - INMARSAT
  - 64 radar course, first 2 weeks
  - Aids to navigation
  - Search and rescue (SAR)
  - AN/WSC-3
  - Electronic fundamentals, A-School
  - Test equipment
- General military training.

It was suggested that certain courses should be tailored to the particular ship, such as a damage control CBT course.

Some courses may be wholly converted into a nonresident CBT form, as was accomplished with the AN/WSC-3 course. Some long courses may require conversion into two or more CBT courses, due to their length. Some courses may require a partial conversion to a CBT format, while retaining a resident course component. In these latter courses, either the nonresident CBT course or the new resident course may become the prerequisite for the other.

It should be expected that large-scale implementation of nonresident training may necessitate changes to many USCG courses, even those not directly affected by conversion. Such changes may be the most cost-effective way of achieving the resident-based training requirements associated with the courses that have been partially converted. For example, the A-School curriculum might be modified to include more hands-on training, and thus facilitate conversion

of certain courses to CBT form. Also, the resident-based parts of certain partially converted courses may be combined into a single new course.

5.13.2 Nonresident Training Implementation Plan

A detailed implementation plan should be developed to guide transition from resident to nonresident training, if large-scale nonresident training is to be implemented. A phased transition process is suggested, to allow a gradual growth of user familiarity and trust, necessitating a well thought-out plan. Most persons interviewed stressed that simply implementing nonresident training within the current USCG structure would not work. Many issues need careful consideration, and pragmatic solutions. The implementation plan would be the blueprint for converting the USCG's training system, representing the implementation decisions. Several suggestions follow.

The many issues addressed in this document show that large-scale nonresident training will require some re-organization of the Coast Guard's infrastructure, affecting both operations and training. The required decisions include organizational changes to establish a system for managing resident and nonresident training, including the necessary checks and balances to assure that effective training is achieved on a regular basis at all duty stations. It includes a system to convert, modify and develop the resident and nonresident courses and materials; to evaluate and upgrade courses when necessary. And it includes the structure at the duty station to manage and conduct training on a daily basis.

The Implementation Plan should generate detailed trade-off information about the most promising approaches to the many relevant issues. Strawmen policies and procedures, when appropriate, should be developed and field-tested. This process should work toward the second phase, the detailed plan for implementation. The plan must address the issues identified in this report, and those subsequently identified. It should also address the USCG organizations that will play major roles in the development, implementation and later conduct of nonresident training.

Nonresident training should be evolved carefully, to assure that the converted courses are effective, and to guide the development of effective training practices at duty stations. An important part of the early implementation phase should be to validate nonresident courses, to demonstrate the effectiveness of nonresident training in different operational settings, and for different types of training objectives. It is imperative that the courses converted be of high quality, and effective. The marketing of nonresident training to all levels within the USCG should be an important objective during the early phase.

The later phases should accelerate the course conversions, to take advantage of the developing infrastructure and readiness for nonresident training at the duty stations. Early lessons learned should be addressed by adapting the developing system. And, the major elements of the revised infrastructure should be implemented. A well thought-out plan is essential to development and implementation of an effective resident/nonresident training system.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

Operation and maintenance training delivered at USCG duty stations via nonresident CBT can be as effective as instructor-led training (courses) conducted at resident training centers. The results of this study also show that CBT courses delivered to students at resident training centers can be as effective as instructor-led courses conducted at resident training centers. Each of the three training methods investigated in this study (CBT Duty Station, CBT Remote (Resident), and Resident (Instructor-led resident)) were effective in imparting knowledge to the students. Significant training gains were measured for each method.

A computer-based version of the AN/WSC-3(v)7 UHF Transceiver Maintenance Course was effectively conducted at 13 USCG duty stations, including cutters and shore-stations on the East, Gulf, and West coasts. This training was found to be equal in effectiveness to the instructor-led version of the course conducted at a resident training center. Commanders, students, and other staff members interviewed at participating duty stations, strongly support implementation of nonresident training (e.g., CBT, IVT) on a large scale within the USCG. However, successful implementation of nonresident training will require a substantial effort by the USCG to develop and execute a training process at duty stations that will be effective. These and related conclusions are presented in this subsection of the report.

Nonresident CBT at Duty Stations

Substantially reduced training time is a potentially major benefit of nonresident CBT conducted at duty stations, in comparison with traditional instructor-led resident training. The nonresident CBT version of the AN/WSC-3 course required an average 70% less training time than the equivalent instructor-led resident course. This advantage was due to CBT methodology, and not the training location; similar reductions in training time were achieved with the CBT course conducted at the training center.

Students identified strengths and weaknesses of nonresident CBT conducted at duty stations. The most beneficial parts of the AN/WSC-3 CBT course identified were characteristics inherent to CBT (e.g., self-paced training), advantages of training at their duty stations, and less training time. They strongly approved of the AN/WSC-3 CBT course's user interface. Additional practice problems were the most-often-cited need for improvement. Other needs cited included additional theory, and hands-on training at their duty station, rather than at the training center.

The equivalent effectiveness of nonresident CBT and resident training refers to a potential of equality, rather than a certainty of equality. The actual long-term effectiveness of nonresident CBT across the USCG will depend heavily on the manner in which the training is conducted at duty stations (i.e., the specific training process at each duty station). The experiment exerted a high degree of control over the one-time training, with participants informed of the importance of their thoughtful participation. A large-scale nonresident training process will have to create an environment conducive to effective training at duty stations.

Personnel Support of Nonresident Training at Duty Stations

Duty station staffs, at command and supervisory levels, who have had experience with nonresident CBT, strongly support the implementation of training at their duty stations. They feel that nonresident training (e.g., CBT, IVT) can definitely succeed in the USCG, and will be a major benefit to duty stations. The primary reason for this support is two-fold: 1) nonresident training gives the duty station much greater flexibility in training its staff; and 2) nonresident training is less of a time burden on the duty station, resulting in greater availability of staff to assist with normal and emergency activities. Nonresident training is viewed by duty station staff as:

- Having less adverse impact than resident training on the overall team's ability to perform its mission; resulting in greater staff availability; minimizing unit disruptions; easing unit staffing problems; and resulting in increased training efficiency.
- Assisting their general unit training requirements.
- A partial solution to problems associated with minimal-crewed vessels.
- Helping the pipeline training problem.

Students are concerned about the need to develop a duty station environment that is conducive to training, if nonresident training is to succeed. Students were generally favorable toward nonresident training, although a range of opinions was expressed. There was an indication in the data, although not a significant finding, that the students were slightly more positive toward training at the resident training centers. This indication was concluded to infer that, today, the training center environment is more conducive to training than that of the duty station. This conclusion further suggests the need to carefully construct, and maintain, the duty station environment in a manner favorable to the achievement of training. The students cited specific characteristics of the duty station training environment that must be improved to assure an adequate training process. Most important among these were the need for elimination of training interruptions, combined training and work prioritizing and scheduling, and increasing command emphasis on training.

Implementation of Nonresident Training at Duty Stations

Duty station staff, in addition to their support of nonresident training (e.g., CBT, IVT), also believe existing obstacles must be overcome with careful organization, and development and execution of the training process. Essential to success is duty station flexibility in directing the training. Many implementation issues are identified in the report, with alternative suggestions given for their resolution. In summary, it is concluded that an effective training process at duty stations requires the following:

- Strong overt command support for training should be given, at all levels across the USCG.
- Sufficient time should be provided daily, during normal work hours, for the conduct of training. Training should be scheduled like any other work task.

- Interruptions must not be allowed while students are actively engaged in training, except for real emergencies.
- The area and room in which a student is training must have an environment conducive to learning, such as minimizing distractions.
- The training process and procedures must provide the unit flexibility in scheduling and conducting training in accordance with their particular situation. This includes a strong organizational structure at the duty station, and at other levels in the USCG, to manage training.
- Selection of courses for nonresident training conversion on the basis of a strong potential for their effective implementation in CBT, or other media conducive to duty station training. This means the skills and knowledge to be trained, and the strategies to be employed, favor nonresident methods (e.g., CBT, IVT).
- Development of effective nonresident training courses.

Student motivation is an important factor to the success of nonresident training. Suggestions for dealing with this issue include student supervision and incentives.

The facilitators participating in the duty station training did an adequate job working with the students. Student opinions about the assistance provided by their facilitator varied widely. This underscores the above conclusion about the need to carefully construct and maintain a duty station environment favorable to training, including strong support at all levels of command.

Hands-on training with actual equipment, to augment the CBT medium, is potentially important to the success of many nonresident CBT courses. Effective ways of achieving hands-on training should be decided by each duty station, with guidance provided by Headquarters.

A variety of hardware issues exist. These include:

- Local versus central control of training computers
- Laptop versus desktop computers
- Use of unit CGSWIII computer systems for training. CGSWIII computers were anticipated to be available for training use part-time. However, large scale course conversions to nonresident CBT may require additional multimedia computer systems at many USCG units, or supporting sites.

A centralized quality assurance process should be developed as a check-and-balance, to assure that an adequate level of training effectiveness is developed and maintained at all duty stations. This process should also be responsible for maintaining, modifying and upgrading courses as necessary.

Nonresident training involving classified material will require special consideration, for information handling and storage, training hardware and training space. These requirements are not currently met at all duty stations.

It is likely that a proportion of the courses currently taught at training centers, and also modules within courses if not the whole course, may be effectively converted to nonresident training. The

suitability of a course for nonresident training will depend on the training objectives, course content, training methods, and other factors.

The method of student certification (e.g., awarding a qualification code), after completion of a nonresident course, is an important issue. Suggestions for dealing with this issue were identified.

A detailed transition plan is required to guide the implementation of nonresident training across the USCG. This plan will require substantial additional research to resolve many of the identified issues, as well as other issues pertinent to the establishment of an effective training process at duty stations.

Investigation Methodology

A high degree of consistency in the results was obtained across the variety of data collected and analyses performed. This indicates good reliability in the data, and high confidence in the findings.

The highly structured and applied hands-on testing methodology, developed under this investigation, was suitable for the evaluation of AN/WSC-3 operation and maintenance proficiency. The hands-on testing methodology, although developed specifically for this study, has a generic structure that may be useful to evaluation of operation and maintenance skills in other domains, and for other purposes. The structure is based on generic assessment techniques and characteristics, and has both generic and AN/WSC-3 specific content. This conclusion was reached after application of the hands-on test to evaluate students during the performance of 235 troubleshooting problems. The independent evaluators' assessments agreed well with each other, and their overall judgments agreed well with the detailed performance scoring.

6.2 RECOMMENDATIONS

The USCG should proceed with the implementation of nonresident training at duty stations. This will require selection of courses to convert, determining the appropriate cost-effective media mix (e.g., CBT, IVT, correspondence) for each course selected, conversion of the courses, and establishment of an effective training process at duty stations. Establishing an effective training process will be complex, requiring careful investigation of many issues, implementation of prototype courses and processes, and making pragmatic decisions to create a duty station environment conducive to training.

The many issues associated with large-scale implementation of nonresident training are expected to require some re-organization of the USCG's infrastructure, affecting both operations and training. These should include organizational changes for managing resident and nonresident training, and the necessary checks-and-balances to assure that effective training is achieved on a regular basis at duty stations. The establishment of nonresident training at duty stations should be a cautious phased process, rather than a bulk implementation.

The selection of resident courses for conversion should move forward. These should be prioritized on the basis of potential for successful implementation, considering the many relevant factors. Development should begin for several of the highest priority courses only. Many

recommendations have been made identifying courses to convert. These are presented in the body of the report, under Section 3.3.3, Application of Nonresident Training, and Section 5.13.1, Course Conversions.

Special emphasis should be placed on assuring that the initial courses converted to a nonresident basis, are as effective as the resident courses they replace. These courses will provide the very important role model for subsequent course development. More importantly, they will provide the foundation for initial acceptance, or rejection, of nonresident training across the USCG. And, these initial courses will be central to development of the training process and procedures at duty stations.

The students taking the AN/WSC-3 CBT course made a variety of improvement recommendations, which are addressed in Section 3.3, Student Reaction to the AN/WSC-3 CBT Course. Most notable of these was the addition of more practice problems in the CBT medium.

Many suggestions for establishment of an effective training process at duty stations were made during the interviews, and are addressed in the report under Section 5, Duty Station Implementation Analysis Findings. Examples of important recommendations are:

- **Strong overt command support** for duty station training, at all levels across the USCG, must be given and demonstrated.
- **Duty station training process and procedures** should consider the following:
  - Daily blocks of training time during normal work hours should be made available to students when engaged in a nonresident course. These should be scheduled along with work tasks, to ensure sufficient training time on a regular basis.
  - Appropriate training spaces should be designated at each duty station. These may include rooms at the facility (e.g., compartment on a cutter), nearby rooms (e.g., pierside office), and the student's home. The training space, which may be identified on an individual student basis, should provide an environment conducive to learning (e.g., no interruptions or distractions).
  - A training person should be designated to oversee the management of training at each duty station. A facilitator should be designated to monitor and assist each student taking a course.
  - The required training process characteristics must not reduce the duty station's flexibility to control and conduct training in accordance with their particular situation.
- **Student-help hotline** - is recommended in association with each course, to provide all duty station students with immediate access to a subject matter expert, to answer technical questions.
- **Standard student-computer interface** - should be specified to assure commonality across all nonresident courses. This interface requirement should also permit evolution in accordance with commercial computer products.
- **Hands-on training** - may be necessary to support certain courses. Each duty station should decide the best method for achieving such requisite training, in accordance with guidance provided by a central training authority, based on the particular duty station and student situations.

A section should be added to the USCG's PCO/PXO Course, addressing the establishment and conduct of an effective training process at duty stations.

An internal USCG marketing effort should be established, to inform personnel at all levels about nonresident training. A variety of opinions, often strong, exist regarding the advantages and disadvantages of training at duty stations. As noted in the report, several persons interviewed expressed initial negative opinions about the AN/WSC-3 CBT course and this type of training, but later changed their opinions after experiencing the training first-hand.

Software tools should be developed for the duty station, to support training management, monitoring and oversight of student training, and administrative coordination with the central training authority.

Guidelines should be developed for duty stations, providing guidance on how to develop and conduct an effective training process. They should not limit the duty station's flexibility, but rather should provide help in establishing a training process tailored to the unit's particular situation. Similar guidelines should be developed for all levels of the USCG, providing assistance in their establishment and conduct of an effective training process, as appropriate.

The use of formal training centers, located on or near a duty station, should be considered. A training center at the duty station, similar to those at shoreside support units, would be appropriate for larger units, including shoreside and shipboard. These may also be helpful to smaller units when located nearby, since some smaller units may have difficulty in making appropriate training spaces available on a regular basis.

A detailed transition plan should be developed to guide the shift from resident to nonresident training, if large-scale nonresident training is to be implemented. The initial phase of the plan should generate detailed information for the alternative approaches to the many relevant issues, and decisions made. Strawmen policies and procedures should be developed and field-tested. The initial courses implemented should be evaluated, focusing on both the course and training process, to identify and mitigate problems. The marketing of nonresident training to all USCG personnel should be an important part of this initial phase. This process should work toward the detailed plan and schedule for later large-scale course conversion and implementation. The later phases should accelerate the course conversions, to take advantage of the developing infrastructure and readiness for nonresident training. The goals of the implementation plan should be specification of a capable training organization, with an effective training process at duty stations, and the appropriate courses converted and implemented in nonresident training.

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APPENDIX A

HANDS-ON PROBLEMS DESCRIPTION AND SCORING

This appendix provides information on:

A.1 Hands-on problems
A.2 Scoring of hands-on problems

A.1 HANDS-ON PROBLEMS

The 5 hands-on problems are listed below, including: 1) the symptoms and situation information given to the student; 2) the fault inserted into the AN/WSC-3 UHF transceiver; and 3) the action the student had to take to correct the malfunction. The student was given only the symptoms and situation information.

- **Problem #1.**
  - **Symptoms and Situation**: A fellow technician was running BITE tests on the AN/WSC-3 and had a bunch of BITE's fail. You were called in to troubleshoot the radio.
  - **Fault**: 1A1A6 Translator Bypass Module bad.
  - **Corrective Action**: Replace the 1A1A6 Translator Bypass Module.

- **Problem #2.**
  - **Symptoms and Situation**: The TC1 notifies you that the AN/WSC-3 will not transmit or receive. You need to repair the radio before the cutter can get underway.
  - **Fault**: 1A1A23 5 MHz Oscillator signal bad.
  - **Corrective Action**: Replace the 1A1A23 5 MHz Oscillator.

- **Problem #3.**
  - **Symptoms & Situation**: The CO tells you she can barely hear in both AM and FM on the AN/WSC-3. Your liberty is on hold until you repair the radio.
  - **Fault**: 1A1A16 IF Amplifier Module bad.
  - **Corrective Action**: Replace the 1A1A16 IF Amplifier Module.

- **Problem #4.**
  - **Symptoms & Situation**: Chief calls you in because the AN/WSC-3 does not transmit. Fix it.

- **Fault**: Carrier signal from 1A1A8 Synthesizer module missing.
- **Corrective Action**: Replace the 1A1A8 Synthesizer module.

- **Problem #5.**

  - **Symptoms & Situation**: The ET1 installed a new AN/WSC-3 and it doesn't work. He wants you to troubleshoot and repair the radio.
  - **Fault**: Jumpers are not installed on 1A1TB4.
  - **Corrective Action**: Install the jumpers correctly on 1A1TB4.

A.2 SCORING OF HANDS-ON PROBLEMS

Assessment Structure. An assessment structure was developed to identify performance criteria related to AN/WSC-3 troubleshooting and maintenance, to be used as the basis for judging student proficiency during each hands-on problem. A single assessment structure was developed for application to all of the five hands-on problems. The structure's framework focused on six dimensions of performance, which mirrored the general troubleshooting and maintenance process students were expected follow during each problem:

- Symptoms
- Sectionalization
- Localization
- Isolation
- Corrective Action
- Overall Performance (Documentation and Safety)

Several task-items were identified under each dimension, also generically pertaining to all 5 problems, resulting in a minimum of 22 individual task-items and overall characteristics that were evaluated for each hands-on problem. The two evaluators independently judged student performance for each task-item, and awarded a number of points for each. Detailed scoring criteria were developed for each task-item, to provide a highly structured framework for the evaluator judgments and awarding of points. The criteria specified up to 5 levels of performance for each task-item (0 through 4 points), with general criteria and specific examples given for each point level. An evaluation criteria guide was developed, providing detailed information to guide the evaluation process. An accompanying evaluation form was developed for recording of the task-item scores. This form also contained abbreviated guidance information for the judgment and awarding of points under each task-item.

Student Problem Score. Student performance solving the hands-on problems was independently assessed by each evaluator, for each student. This resulted in two sets of problem scores for each student, one set from each evaluator. Scores in each set were summed (i.e., across the five problems for each evaluator) to yield a single evaluator score for each student. The two evaluator scores were averaged to yield the single hands-on problem score for each

student (i.e., student problem score). The scores were also normalized to a basis of 100% during this process.

The student problem score was derived, for each student, on the basis of:

Task-item score = Judgment of evaluator, in accordance with structured scoring criteria, weighted according to task importance.
Dimension score = Sum of task-item scores (multiple task-items for each dimension)
Problem score = Sum of dimension scores (across 6 dimensions)
Evaluator score = Sum of problem scores (across 5 problems)
Student problem score = Mean of evaluator scores (across 2 evaluators)

The task-item scores, and the resulting dimension scores, were also differentially weighted in accordance with their relative importance. The determination of task-item and dimension weights was accomplished together with the TRACEN Petaluma SMEs.

Scoring Weights. The evaluator score for each problem was arrived at by summing the individual task-item scores assigned by the evaluator, with transformation in accordance with assigned item and dimension weights. The individual task-item assessments, transformed in accordance with assigned weights, were summed to yield the respective dimension scores for each problem, for that evaluator. The dimension scores were also transformed in accordance with assigned weights, and summed to yield the single problem score. The problems were treated equally, with their scores summed to yield an aggregate hands-on problem score. This aggregate score was averaged across both evaluators to generate the single hands-on problem score for the student, which was evaluated to determine training effectiveness.

The task-item weights and the dimension weights were developed with the assistance of the AN/WSC-3 SMEs at TRACEN Petaluma. Table A-1 presents the weights assigned to the individual task items, with the task-items grouped under the respective dimensions. Table A-2 presents the dimension weights.

TABLE A-1. TASK ITEM WEIGHTS

DIMENSIONS	TASK ITEMS	Item Weight
SYMPTOMS	Performance Test	2.0
	List Faulty Symptoms	2.0
	List Faulty Equipment	1.4
	Next Troubleshooting Procedure	1.8
SECTIONALIZATION	Additional Tests Needed	1.8
	Identify Most Probable Faulty Functional Area(s)	2.0
LOCALIZATION	BITE Test	2.0
	Identify Most Probable Faulty Module	2.0
ISOLATION	Explain Method of Troubleshooting	1.7
	Explain Next Troubleshooting Point	1.5
	Testing - Setup and Performance	2.0
	Interpret Performance	2.0
CORRECTIVE ACTION	Replace Faulty Module or Item	1.5
	Alignment	1.4
	Performance Test	1.7
OVERALL PERFORMANCE	Documentation Usage	1.2
	Safety	1.0

The item weights provided the relative contribution of each task item to the performance under each dimension. For example, under the *Localization* dimension, the *BITE Test* and the *Identify Most Probable Faulty Module* items each contributed 50% of the performance to that dimension; they were weighted the same within that dimension. Similarly, the dimension weights provided the relative contribution of each dimension to the performance on each problem. This resulted in a two-tiered weighting system for scoring student performance

TABLE A-2. DIMENSION WEIGHTS

DIMENSIONS	Dimension Weight
SYMPTOMS	1.8
SECTIONALIZATION	1.1
LOCALIZATION	2.7
ISOLATION	2.7
CORRECTIVE ACTION	0.7
OVERALL PERFORMANCE (Documentation & Safety)	1.0
Total Dimension Weight	**10.0**

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APPENDIX B

STUDENT CRITIQUE QUESTIONNAIRES

This appendix contains the three versions of the Student C-School Critique, for the three student groups:

Duty Station Group (CGSCH-5-DS)
Remote Group (CGSCH-5-RM)
Resident Group (CGSCH-5-RS)

Department of Transportation
U. S. Coast Guard
CGCSCH-5-DS (REV 7/96)

DUTY STATION GROUP

C-SCHOOL CRITIQUE SHEET

NAME: _____

Course: _____ Class Number:_____

In order to improve the course and to provide a measure of quality assurance, we need your feedback on this critique. Circle the number next to each statement that best expresses your opinion. Space is provided for writing amplifying comments. We especially encourage comments an any statements you disagree with. Use the backside of pages if necessary.

	O-N/A 1-Strongly Disagree 2-Disagree 3-Agree 4-Strongly Agree					
1.	I am very confident of my ability to maintain this equipment.	0	1	2	3	4
2.	Testing clearly measured my ability to perform each objective.	0	1	2	3	4
3.	Plenty of practice is provided for each objective.	0	1	2	3	4
4.	Proper troubleshooting techniques are taught, and tested.	0	1	2	3	4
5.	Troubleshooting problems are realistic.	0	1	2	3	4

6.	Course is presented in a logical sequence.	0	1	2	3	4
7.	Course length is ideal.	0	1	2	3	4
8.	Proper tools and test equipment are always available in the computer media.	0	1	2	3	4
9.	Spare parts are available and ready for use in computer media.	0	1	2	3	4
10.	Safety equipment is always available.	0	1	2	3	4
11.	Training and visual aids enhanced learning.	0	1	2	3	4
12	Technical manuals are current, legible, and accessible.	0	1	2	3	4
13.	HELP information on the computer was understandable and enhanced training.	0	1	2	3	4
14.	Course work directly relates to course objectives.	0	1	2	3	4

15.	Welcome aboard package is very helpful.	0	1	2	3	4
16.	The facilitator clearly and concisely answered all questions.	0	1	2	3	4
17.	Facilitator maintained control.	0	1	2	3	4
18.	Facilitator is knowledgeable, skillful, and confident in assisting training process.	0	1	2	3	4
19.	Facilitator strictly enforced safety standards.	0	1	2	3	4
20.	Training environment was comfortable and functional.	0	1	2	3	4
21.	There is good visibility in training room/spaces.	0	1	2	3	4
22.	There were no distractions during training.	0	1	2	3	4
23.	Training time was never wasted.	0	1	2	3	4

24.	I was well prepared to take this AN/WSC-3 course.	0	1	2	3	4
25.	The AN/WSC-3 course was directly relevant to my job.	0	1	2	3	4
26.	The quality of training was satisfactory.	0	1	2	3	4
27.	The course was effective overall.	0	1	2	3	4
28.	The AN/WSC-3 computer-based course was as effective as a traditional classroom/lab course.	0	1	2	3	4
29.	The level of AN/WSC-3 instruction detail was sufficient.	0	1	2	3	4
30.	The AN/WSC-3 computer-based course was challenging.	0	1	2	3	4
31.	The amount of general theory provided was sufficient.	0	1	2	3	4
32.	The computer medium was satisfactory for the practice problems.	0	1	2	3	4

33.	Some AN/WSC-3 equipment hands-on training should be provided after completing the computer-based part of the course.	0	1	2	3	4
34.	The computer-based training materials were user friendly and easy to use.	0	1	2	3	4
35.	The computer and software worked satisfactorily.	0	1	2	3	4
36.	I had no difficulty learning to use the computer for this course.	0	1	2	3	4
37.	The training environment (room, table/desk where trained on the computer) was satisfactory.	0	1	2	3	4
38.	The time made available for me to do the course was adequate.	0	1	2	3	4
39.	Computer-based training at duty stations can be effective in the Coast Guard.	0	1	2	3	4
40.	My command strongly supported this AN/WSC-3 computer-based training.	0	1	2	3	4
41.	I had no difficulty in setting up and conducting the computer-based training.	0	1	2	3	4
43.	There was very little interference from others during my training sessions.	0	1	2	3	4

44. The computer and all necessary guidance and training materials were satisfactorily received at my duty station. 0 1 2 3 4

Please provide your opinions to the following questions. Use page backsides or additional sheets if necessary.

45. The **most** beneficial part of this course was_____

_____

_____

46. The **least** beneficial part of this course was_____

_____

47. What additional information, materials or help would have improved your training experience?_____

_____

48. What additional AN/WSC-3 topics would you like to see added to this course?_____

_____

49. In what other Coast Guard training areas or courses might computer-based training be effective?_____

_____

50. My suggestions for improving this type of individual computer-based training at duty stations are:_____

_____

Please use the space below to provide us any remarks (positive or negative) concerning the course. Use page backsides or additional paper if needed. Thank you.

Department of Transportation
U. S. Coast Guard
CGCSCH-5-RM (REV 7/96)

REMOTE GROUP

C-SCHOOL CRITIQUE SHEET

NAME: (optional) _____

Course: _____ Class Number:_____

In order to improve the course and to provide a measure of quality assurance, we need your feedback on this critique. Circle the number next to each statement that best expresses your opinion. Space is provided for writing amplifying comments. We especially encourage comments an any statements you disagree with. Use the backside of pages if necessary.

O-N/A 1-Strongly Disagree 2-Disagree 3-Agree 4-Strongly Agree

1.	I am very confident of my ability to maintain this equipment.	0	1	2	3	4
2.	Testing clearly measured my ability to perform each objective.	0	1	2	3	4
3.	Plenty of practice is provided for each objective.	0	1	2	3	4
4.	Proper troubleshooting techniques are taught, and tested.	0	1	2	3	4
5.	Troubleshooting problems are realistic.	0	1	2	3	4
6.	Course is presented in a logical sequence.	0	1	2	3	4

7.	Course length is ideal	0	1	2	3	4
8.	Proper tools and test equipment are always available in the computer media.	0	1	2	3	4
9.	Spare parts are available and ready for use in computer media.	0	1	2	3	4
10.	Safety equipment is always available.	0	1	2	3	4
11.	Training and visual aids enhanced learning.	0	1	2	3	4
12	Technical manuals are current, legible, and accessible.	0	1	2	3	4
13.	HELP information on computer is understandable and enhances training.	0	1	2	3	4
14.	Course work directly relates to course objectives.	0	1	2	3	4
15.	Welcome aboard package is very helpful.	0	1	2	3	4
16.	The facilitator clearly and concisely answered all questions.	0	1	2	3	4

17.	Facilitator maintained control.	0	1	2	3	4
18.	Facilitator is knowledgeable, skillful, and confident in assisting training process.	0	1	2	3	4
19.	Facilitator strictly enforced safety standards.	0	1	2	3	4
20.	Training environment was comfortable and functional.	0	1	2	3	4
21.	There is good visibility in training room/spaces.	0	1	2	3	4
22.	There were no distractions during training.	0	1	2	3	4
23.	Training time was never wasted.	0	1	2	3	4
24.	I was well prepared to take this AN/WSC-3 course.	0	1	2	3	4
25.	The AN/WSC-3 course was directly relevant to my job.	0	1	2	3	4
26.	The quality of training was satisfactory.	0	1	2	3	4

27. The course was effective overall.	0	1	2	3	4
28. The AN/WSC-3 computer-based course was as effective as a traditional classroom/lab course.	0	1	2	3	4
29. The level of AN/WSC-3 instruction detail was sufficient.	0	1	2	3	4
30. The AN/WSC-3 computer-based course was challenging.	0	1	2	3	4
31. The amount of general theory provided was sufficient.	0	1	2	3	4
32. The computer medium was satisfactory for the practice problems.	0	1	2	3	4
33. Some AN/WSC-3 equipment hands-on training should be provided after completing the computer-based part of the course.	0	1	2	3	4
34. The computer-based training materials were user friendly and easy to use.	0	1	2	3	4
35. The computer and software worked satisfactorily.	0	1	2	3	4
36. I had no difficulty learning to use the computer for this course.	0	1	2	3	4

37.	The training environment (room, table/desk where trained on the computer) was satisfactory.	0	1	2	3	4
38.	The time made available for me to do the course was adequate.	0	1	2	3	4
39.	Computer-based training at duty stations can be effective in the Coast Guard.	0	1	2	3	4

Please provide your opinions to the following questions. Use page backsides or additional sheets if necessary.

40. The **most** beneficial part of this course was_____

_____

41. The **least** beneficial part of this course was_____

_____

42. What additional information, materials or help would have improved your training experience?_____

_____

43. What additional AN/WSC-3 topics would you like to see added to this course?_____

_____

44. In what other Coast Guard training areas or courses might computer-based training be effective?_____

_____

45. My suggestions for improving this type of individual computer-based training at duty stations are:_____

_____

Please use the space below to provide us any remarks (positive or negative) concerning the course. Use page backsides or additional paper if needed. Thank you.

Department of Transportation **RESIDENT GROUP**
U. S. Coast Guard
CGCSCH-5-RS (REV 7/96)

C-SCHOOL CRITIQUE SHEET

NAME: (optional) _____

Course: _____ Class Number:_____

In order to improve the course and to provide a measure of quality assurance, we need your feedback on this critique. Circle the number next to each statement that best expresses your opinion. Space is provided for writing amplifying comments. We especially encourage comments an any statements you disagree with. Use the backside of pages if necessary.

O-N/A 1-Strongly Disagree 2-Disagree 3-Agree 4-Strongly Agree

1.	I am very confident of my ability to maintain this equipment.	0	1	2	3	4
2.	Testing clearly measured my ability to perform each objective.	0	1	2	3	4
3.	Plenty of practice is provided for each objective.	0	1	2	3	4
4.	Proper troubleshooting techniques are taught, and tested.	0	1	2	3	4
5.	Troubleshooting problems are realistic.	0	1	2	3	4
6.	Course is presented in a logical sequence.	0	1	2	3	4
8.	Proper tools and calibrated test equipment are always available.	0	1	2	3	4

9.	Spare parts are plentiful and ready for issue.	0	1	2	3	4
10.	Safety equipment is always available.	0	1	2	3	4
11.	Training and visual aids enhanced learning.	0	1	2	3	4
12	Technical manuals are current, legible, and accessible.	0	1	2	3	4
13.	Handouts are legible and enhance training.	0	1	2	3	4
14.	Course work directly relates to course objectives.	0	1	2	3	4
15.	Welcome aboard package is very helpful.	0	1	2	3	4
16.	The instructor clearly and concisely answered all questions.	0	1	2	3	4
17.	Instructor maintained interest and control of class.	0	1	2	3	4
18.	Instructor is knowledgeable, skillful, and confident.	0	1	2	3	4

19.	Instructor strictly enforced safety standards.	0	1	2	3	4
20.	Classroom and labs are comfortable, and functional.	0	1	2	3	4
21.	There is good visibility in classroom and lab.	0	1	2	3	4
22.	There are no distractions to the class.	0	1	2	3	4
23.	Class time is never wasted.	0	1	2	3	4
24.	I was well prepared to take this AN/WSC-3 course.	0	1	2	3	4
25.	The AN/WSC-3 course was directly relevant to my job.	0	1	2	3	4
26.	The quality of training was satisfactory.	0	1	2	3	4
27.	The course was effective overall.	0	1	2	3	4

28. The level of AN/WSC-3 instruction detail was sufficient. 0 1 2 3 4

29. The amount of general theory provided was sufficient. 0 1 2 3 4

Please provide your opinions to the following questions. Use page backsides or additional sheets if necessary.

30. The **most** beneficial part of this course was_____

_____

31. The **least** beneficial part of this course was_____

_____

32. What additional information, materials or help would have improved your training experience?_____

_____

33. What additional AN/WSC-3 topics would you like to see added to this course?_____

_____

Please provide us any remarks (positive or negative) concerning the course. Use page backsides or additional paper if needed. Thank you.

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APPENDIX C

EXPERIMENT MATERIALS

This appendix contains summary information about experiment materials, presented in the following subsections:

C.1 TRAINING MATERIALS

The three student groups used the same reference publications during their respective courses, which were:

AN/WSC-3(v)7 Technical Manuals
AN/WSC-3(v)7 Student Guide
Student Corrective Maintenance Log Sheets

The two volume set of AN/WSC-3 technical manuals, which were developed and supplied by the U.S. Navy, are the standard reference for operating, troubleshooting, and maintaining the UHF transceivers. These manuals were augmented by the AN/WSC-3(v)7 UHF transceiver Student Guide (course book) developed by TRACEN Petaluma. The course book provided additional guidance and training-related information. The *Student Corrective Maintenance Log Sheets* were blank forms used by students to write down observations and other information during the troubleshooting and maintenance work. Students were instructed, in each group, to use these forms during the troubleshooting problems (These forms were also used by the students during the hands-on testing problems). These three documents were identical for each of the three groups.

The CBT Duty Station (DS) and CBT Remote (RM) groups used the AN/WSC-3 CBT course medium, in addition to the technical manuals and course book. The computer medium contained the bulk of course material, which was stored on the laptop PC's hard drive. In addition, the CBT students received a 3-page document, *Computer Turn-On/Off Procedures*, to guide them in the mechanics of operating the laptop computer.

The Resident (RS) group used the equipment and other media in the AN/WSC-3 lab at TRACEN Petaluma (e.g., AN/WSC-3 transceivers) during their course.

Additional information about the two course versions is provided in Section 2.1.2, AN/WSC-3 Course.

C.2 CBT DUTY STATION GROUP

Materials were developed for, and sent to, three persons at each duty station: 1) Commanding Officer; 2) Facilitator (The person, usually the student's immediate supervisor, who would oversee the AN/WSC-3 CBT course conduct); and 3) Student. Introductory letters were sent to all three participants, a month prior to start of the duty station training period. The set of materials sent to each duty station consisted of the following, each of which is explained briefly below:

Facilitator Guideline
Facilitator Job Aids
Student Guideline
Duty Station Facilitator Questionnaire
Student Background Questionnaire
Pretest

Facilitator Guideline. This document was used by the facilitator to oversee the CBT-related activities at the duty station. It contained a series of tasks and subtasks to be accomplished by the Facilitator, independently and with the student. It also provided guidance about the tasks and subtasks, facilitator job aids, and a detailed schedule for the activities.

Facilitator Job Aids. Several job aids were developed to assist the Facilitator in performing required tasks. They included:

- **Facilitator Check-Off Sheet** - Listing of tasks, subtasks, completion dates, guideline reference pages, and spaces for recording task completions.
- **Facilitator Tasks Outline** - Flowchart of duty station activities.
- **Packing List** - List of received computer and material.
- **Task/Subtask Schedule** - Detailed schedule of data collection and training activities.
- **HELP Process** - Summary of HELP available and procedures.
- **Return Shipping Guide** - Summary of return shipment package contents (2 packages)

Student Guideline. The 1-page document provided general guidance to the student, addressing training session management, use of materials and obtaining help.

Duty Station Facilitator Questionnaire. This 22-item questionnaire requested judgments by the Facilitator about the CBT course. It was scheduled to be completed after the student finished the course.

Student Background Questionnaire. This questionnaire collected detailed background information about each student. The information categories included:

Prior education (Civilian - High school, trade school, college, other)
Prior education (Military - A-School, B-School, C-Schools, other)
CLEP/DANTES
Certifications (e.g., FCC)
Service time and assignment history (Unit, type, arrival/departure dates, job title)
History of equipment experience (In addition to formal training)
AN/WSC-3 experience (Operations, Planned Maintenance System, troubleshooting)

Pretest. The Pretest was administered by the Facilitator prior to the start of the training. See additional description under the subsection Section 2.1.5, Performance Measurement Tools.

C.3 CBT REMOTE GROUP

The RM group used the same materials as the DS group, excepting they had modifications necessary to conform with administration of training in the school environment at TRACEN Petaluma. Introductory letters were given to the Facilitator (at TRACEN Petaluma) and sent to each student prior to reporting for the course, which was conducted at TRACEN Petaluma. The TRACEN Petaluma facilitator performed the same role as the facilitators at each of the duty stations. The materials used by the RM group included (See the above Section C.2, Duty Station Group, for an explanation of each):

Facilitator Guideline
Facilitator Job Aids
Student Guideline
Duty Station Facilitator Questionnaire
Student Background Questionnaire
Pretest

C.4 RESIDENT GROUP

The RS group materials used prior-to, and during, the training differed from those of the other two groups. An introductory letter was sent to the RS group students, similar to that of the other groups. The other materials consisted of:

Student Background Questionnaire
Pretest
Instructor Guide supplement

The *Student Background Questionnaire* and *Pretest* administered to these students was identical to that of the other groups.

Instructor Guide Supplement. The standard AN/WSC-3 Course's Instructor Guide was supplemented by material addressing the experiment, similar to that in the *Facilitator Guide* for

the other two groups. This included, for example, a *Training Project Introduction, Instructor Outline*, which was used to brief students at the start of the course. With the exception of the initial data collection (i.e., *Student Background Questionnaire* and *Pretest*) the resident course was conducted in the traditional fashion, and required no experiment-unique tasks by the instructor.

C.5 TRACEN PETALUMA EVALUATION

The post-training and testing conducted at TRACEN Petaluma was performed the same for all groups, and used the same materials, as follows:

Faulted AN/WSC-3 modules
Evaluator Guideline
Scoring Criteria Guideline; Scoring sheet
AN/WSC-3 transceiver and lab materials

Faulted AN/WSC-3 Modules. The 5 hands-on problems were effected by inserting faulted modules into the AN/WSC-3 transceivers in the lab at TRACEN Petaluma. The faulted modules were developed by the TRACEN Petaluma SMEs.

Evaluator Guideline. This document was used by the Evaluators to oversee the testing activities. It contained a series of tasks and subtasks to be accomplished by the Evaluators. It also provided guidance about the tasks and subtasks, evaluator job aids, and a detailed schedule of testing activities.

Scoring Criteria Guide, and Scoring Sheet. The guide provided direction to the evaluators for judging aspects of student performance during the hands-on problems. It identified problem dimensions, task-items and scoring criteria, with examples. See Section 2.1.5, Performance Measurement Tools, for additional information.

The Scoring Sheet was a data recording job aid used by the evaluators to record their judgment scores during the hands-on problems. It also provided summary guidance to the evaluators, as an accompaniment to the *Scoring Criteria Guide*. See Section 2.1.5, Performance Measurement Tools subsection for additional information.

AN/WSC-3 Transceiver and Lab Materials. The hands-on testing was conducted in a lab at TRACEN Petaluma, containing 6 rack-mounted AN/WSC-3 transceivers. Other operational equipment was also rack-mounted nearby, appropriately connected to the AN/WSC-3 transceiver. A separate set of test equipment (e.g., oscilloscope) was in an adjoining rack, dedicated for use with that AN/WSC-3 unit.

Each student received a set of materials at the start of each hands-on testing problem. It included the *AN/WSC-3 Technical Manuals* (Volumes 1 and 2), and tools (e.g., test pin adapters). All the

materials and equipment necessary for troubleshooting the AN/WSC-3 UHF transceiver were provided at each AN/WSC-3 station at the start of each problem.

Appendix A, Hands-On Problems, Description and Scoring, provides additional information on the scoring process used to evaluate student performance during the hands-on problems.

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APPENDIX D

EXPERIMENT PROCEDURES

Details of the experiment procedures are summarized in this appendix. They are presented in sections under each student group, as follows:

D.1 CBT DUTY STATION PROCEDURES

Initial contact with each duty station was made approximately one-month before start of that duty station's experiment-support and training activities. The Commanding Officer was contacted initially, with subsequent facilitator contact. The project was introduced, with cooperation requested.

The set of experiment and training materials were shipped to the duty station sufficiently in advance, to allow for a one-week preparation period by the facilitator, prior to the start of the CBT training period. A two-week CBT training period was specified, during which the AN/WSC-3 course had to be conducted. The facilitator administered the Student Background Questionnaire and Pretest at the start of this training period. The facilitator at each duty station was the coordinator for the experiment support activities and AN/WSC-3 training. The facilitator did not get involved in the student's training process.

Immediately following completion of the two-week training period, the student traveled to TRACEN Petaluma for the post-training testing. The testing occupied a three day period at TRACEN Petaluma, including hands-on training as part of the CBT course, lab familiarization, administration of the Posttest, administration of the hands-on test problems, and administration of the C-School Critique.

Facilitator Tasks. The facilitator at each duty station was the coordinator for the experiment support activities and AN/WSC-3 training. It was necessary to have a capable facilitator to achieve experimental control across the DS group students. For this reason, extensive guidance materials and job aids were developed for the facilitator, and tailored to the specific schedule for that DS group section. The schedule of facilitator tasks, which are representative of the schedule of CBT-related activities at each duty station, is presented in Figure D-1.

The complete set of training and experiment materials, including the laptop computer, were shipped to the facilitator at each duty station to arrive more than a week before the scheduled start of the CBT training period. This provided the facilitator with approximately a week to prepare for the training. The facilitator was the project's representative at each duty station. The facilitator's tasks concerned:

Making arrangements with the student and other affected staff for conduct of the training
Receiving and storing the materials
Administration of the *Student Background Questionnaire* and *Pretest*
Oversight of the student's training activities
Completion of the *Facilitator Questionnaire*
Return of the materials

Figure D-1. DUTY STATION FACILITATOR TASK/SUBTASK SCHEDULE

Preparation Week: xxx, 1997
Training Week 1: xxx, 1997
Training Week 2: xxx, 1997
ET student travel departure to TRACEN Petaluma: xxx, 1997

Task/Subtask	Preparation Week							Training Week 1							Training Week 2						
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1. Receive Package	♦																				
a. Inventory contents	♦																				
b. Store Pretest	♦																				
c. Store computer & materials in safe area	♦																				
d. Test notebook computer	♦																				
2. Training Preparation																					
a. Read *Facilitator Guideline*																					
b. CBT course arrangements																					
c. Initial student meeting																					
d. Setup CBT work area																					
3. Start Training Process																					
a. Student Introduction								♦													
b. Admin. Student Background Questionnaire								♦													
c. Administer Pretest								♦													
d. Start CBT course								♦													
4. Conduct Training																					
a. Monitor/oversee training																					
b. Student guidance																					
5. Finish Training																					
a. Training completed																			♦		
b. Oversee Student travel to TRACEN Petaluma																					♦
c. Self-Admin. Duty Station Questionnaire																			♦		
d. Package/ship computer & materials (pkg 1)																			♦		
e. Package & ship data materials (pkg 2)																			♦		

Training Period. A two-week training period was allowed for conduct of the AN/WSC-3 CBT course (Estimates of training time ranged from 6 to 15 hours). The guidance stated that the student must not begin training before the start of the two-week period, and must complete the training by the end of the period. The training period commenced on a Monday, and ended on the Friday twelve days later. Otherwise, the training schedule was left to the discretion of the duty station. Similarly, general guidance was provided on workspace requirements (e.g., quiet, lighting, sufficient desktop space), with the actual arrangements left to the duty station. Generally speaking, the only firm requirement placed on the duty station was the two-week period in which the training had to be conducted.

Travel to TRACEN Petaluma. Each student traveled to TRACEN Petaluma on the Sunday following the end of the two-week training period (i.e., 14 days after the start of the training period).

Hands-On Training. A limited amount of hands-on training with an actual AN/WSC-3 UHF transceiver was considered an essential part of the AN/WSC-3 CBT course. This training was deemed necessary to assist the transfer of skills and knowledge learned in the CBT context to that of the actual hardware. A two-hour hands-on training session, addressing the location of AN/WSC-3 components and test points, and planned maintenance procedures, was developed to meet this requirement. The hands-on training for all affected students (DS and RM groups) was conducted in the AN/WSC-3 lab at TRACEN Petaluma, prior to the start of testing.

The outline of the hands-on training for the DS and RM groups is presented in Table D-1.

TABLE D-1. HANDS-ON TRAINING OUTLINE

1. Familiarization - Instructor Indoctrination
   - Tools
   - Equipment configuration
   - Test Equipment
2. Run performance check
3. Perform BITE tests
4. Test Point Lab
5. Signal Injection Lab
6. Perform PMS Procedure M-1
7. Module Location Lab

Laboratory Familiarization. A 2-hour laboratory familiarization session was developed for the DS and RM group students. Its purpose was to acclimate these students with the AN/WSC-3 lab and its general environment, since lab familiarity could effect student performance, and could be confounded with the hands-on test performance between the CBT and RS groups. The RS group students received their training in the AN/WSC-3 lab, over a 5-day period, and hence had a relatively high level of lab familiarity by the time hands-on testing began. Although it was not possible to provide an equivalent level of lab familiarization for the DS and RM students in the small amount of time available, a 2-hour period was deemed adequate.

The hands-on training and lab familiarization contents were integrated into a single module, for application near the start of the TRACEN Petaluma testing activities. Note, the RS students were allowed an equivalent amount of unstructured familiarization time in the lab (2 hours), following completion of training.

TRACEN Petaluma Post-Training Testing. The testing procedures that were followed at TRACEN Petaluma, after arrival of the DS group students Sunday, were as follows (See the testing schedule in Table D-2):

- **Testing Introduction** - Addressing the testing schedule, including hands-on training and laboratory familiarization.
- **Hands-On Training and Laboratory Familiarization** - Conducted during a 4-hour period Monday morning.
- **Posttest** - Administration of the Posttest Monday afternoon (Approximately 1 hour)
- **Hands-On Testing** - First subsection of three students began testing Tuesday morning. Each student had to solve three separate problems, one each on three different AN/WSC-3 transceivers. The second subsection began testing Tuesday afternoon, addressing the same three problems. Both subsections concluded testing Wednesday, addressing the final two problems (again, with a morning and an afternoon subsection of students).
- **C-School Critique** - The modified C-School Critique was individually administered to each student on Wednesday, immediately following the student's completion of the final hands-on test problem.

TABLE D-2. SCHEDULE OF CBT DUTY STATION GROUP TESTING ACTIVITIES

Time	Sunday	Monday	Tuesday	Wednesday
0730		Introduction (1/2 hr.)	Hands-on Tests (AN/WSC-3 Lab) Problems 1 -3 Subsection A	Hands-on Tests (AN/WSC-3 Lab) Problems 4,5 Subsection B
0800		Lab Familiarization & Hands-on training		
0900				
1000				
1100				C-School Critique
1200				
			Hands-on Tests (AN/WSC-3 Lab) Problems 1 - 3 Subsection B	Hands-on Tests (AN/WSC-3 Lab) Problems 4,5 Subsection A
1300		Post-test (1 hour)		
1400				
1500	Students Arrive			
1600				C-School Critique

D.2 CBT REMOTE GROUP PROCEDURES

The RM group students reported to TRACEN Petaluma the day before the start of training and experiment activities, similar to the RS students (i.e., Sunday). The students gathered Monday morning for the start of training, in a classroom remote from the AN/WSC-3 lab (where the hands-on testing was conducted). The facilitator provided an introduction, and administered the Student Background Questionnaire and Pretest at the start of training, Monday morning. The AN/WSC-3 CBT course then commenced. The students had two-plus days in which to complete the course, before the start of testing late Wednesday morning. The students were permitted to train at their own pace, with the provision that they finish the course by late Wednesday morning.

The post-training and testing process began late Wednesday morning, and concluded Friday afternoon. This testing process was identical to that of the DS and RS groups, with the exception of the time schedule, which differed for each group.

Facilitator Tasks. The RM group facilitator had no special preparation, other than being given guidance materials similar to those provided to the duty station facilitators, about one-week prior to the start of training. The RM facilitator had the same role as that of the DS facilitators (i.e., coordinate the experiment support activities and AN/WSC-3 training, and not get involved in the student's training process), with similar tasks. They received comparable guidance and job aid materials. The RM facilitator's tasks concerned:

Administration of the *Student Background Questionnaire* and *Pretest*
Oversight of the student's training activities
Completion of the *Facilitator Questionnaire*

Hands-On Training and Lab Familiarization. The RM students received the same integrated hands-on training and lab familiarization as that conducted for the DS group, in accordance with the same rationale (See Section D.1, Duty Station Procedures, above).

TRACEN Petaluma Procedures (Pre-training, training, post-training and testing). All RM group activities were conducted at TRACEN Petaluma. The procedures associated with the pre-training, AN/WSC-3 CBT course, post-training and testing activities, were (See the training and testing schedule in Table D-3):

- **Introduction** - Performed by the facilitator Monday morning, addressing experiment and training activities.
- **Student Background Questionnaire** - Administered by the facilitator, Monday morning.
- **Pretest** - Administered by the facilitator, Monday morning.
- **AN/WSC-3 CBT Course** - Started Monday morning at 0930, and continued until Wednesday morning at 1030. The facilitator monitored student progress to assure completion by the scheduled time. The students trained at their own pace, and were able to come-and-go, with the provision that they completed the course on schedule.

- **Testing Introduction** - Performed by the evaluators Wednesday morning at 1100, addressing the testing schedule, including hands-on training and laboratory familiarization.
- **Hands-On Training and Laboratory Familiarization** - Conducted during a 4-hour period Wednesday afternoon.
- **Posttest** - Administration of the Posttest Wednesday afternoon (Approximately 1 hour).
- **Hands-On Testing** - First subsection of three students began testing Thursday morning. Each student had to solve three separate problems, one each on three different AN/WSC-3 UHF transceivers. The second subsection began testing Thursday afternoon, addressing the same three problems. Both subsections concluded testing Friday, addressing the final two problems (again, with a morning and an afternoon subsection of students).
- **C-School Critique** - The modified C-School Critique was individually administered to each student on Friday, immediately following completion of the final hands-on test problem.

TABLE D-3. SCHEDULE OF CBT REMOTE GROUP TRAINING & TESTING ACTIVITIES

Time	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
0730		Introduction (1/2 hr.)	CBT Course	CBT Course	Hands-on Tests	Hands-on Tests
0800		Background Ques. Pre-test	(Continue)	(Continue)	(AN/WSC-3 Lab) Problems 1 -3	(AN/WSC-3 Lab) Problems 4,5
0900		CBT Course Start			Subsection A	Subsection B
1000						
1100				Testing Intro.(1/2 hr) Lab Familiarization		C-School Critique
1200						
1300		CBT Course (Continue)	CBT Course (Continue)	& Hands-on training	Hands-on Tests (AN/WSC-3 Lab) Problems 1 - 3 Subsection B	Hands-on Tests (AN/WSC-3 Lab) Problems 4, 5 Subsection A
1400						
1500	Students Arrive					
1600				Post-test (1 hour)		C-School Critique
1700						

D.3 RESIDENT GROUP PROCEDURES

The RS students reported to TRACEN Petaluma on the day before the start of training and experiment activities, similar to the RM students (i.e., Sunday), and in accordance with normal practice for the traditional resident course. The students began training Monday morning in

accordance with the usual practice for the AN/WSC-3 resident course. The instructor started the course with an introduction to the experiment, and administered the Student Background Questionnaire and Pretest. After that point, and until the conclusion of training activities Friday, the AN/WSC-3 course was conducted in accordance with normal practice, with no deviations for experimental purposes.

The post-training and testing process began Friday afternoon, and concluded during Monday and Tuesday of the following week. This testing process was identical to that of the DS and RS groups, with the exception of the time schedule, which differed for each group.

Instructor Tasks. The instructor conducted training in accordance with normal practices for the resident AN/WSC-3 course. The only instructor tasks that departed from normal practice were those before the start of the training, namely the introduction and administration of the Student Background Questionnaire and the Pretest. Guidance material was provided to the instructor, including a guide and an experiment introduction outline (For the first day's student introduction).

TRACEN Petaluma Procedures (Pre-training, training, post-training and testing). All RS group activities were conducted at TRACEN. The procedures associated with the pre-training, traditional AN/WSC-3 course, post-training and testing activities, were (See the training and testing schedule in Table D-4):

- **Introduction** - Performed by the instructor Monday morning, addressing experiment and training activities.
- **Student Background Questionnaire** - Administered by the instructor, Monday morning.
- **Pretest** - Administered by the instructor, Monday morning.
- **AN/WSC-3 Course** (Traditional) - Started Monday morning at 0930, and continued until Friday afternoon at 1400. The typical resident AN/WSC-3 courses conclude by this time on Friday. The instructor conducted the course in accordance with normal practices.
- **Testing Introduction** - Performed by the evaluators Friday afternoon at 1430, addressing the testing schedule.
- **Laboratory Familiarization** - Conducted during a 2-hour period Friday afternoon.
- **Posttest** - Administration of the Posttest Friday afternoon (Approximately 1 hour).
- **Hands-On Testing** - First subsection of three students began testing Monday morning. Each student had to solve three separate problems, one each on three different AN/WSC-3 transceivers. The second subsection began testing Monday afternoon, addressing the same three problems. Both subsections concluded testing Tuesday, addressing the final two problems (again, with a morning and an afternoon subsection of students).
- **C-School Critique** - The modified C-School Critique was individually administered to each student on Tuesday, immediately following completion of the final hands-on test problem.

TABLE D-4. SCHEDULE OF RESIDENT GROUP TRAINING & TESTING ACTIVITIES

Time	Monday	Tuesday - Thursday	Friday	Saturday & Sunday	Monday	Tuesday
0730	Introduction (1/2 hr.)	Course (Continue)	Course (Continue)		Hands-on Tests	Hands-on Tests
0800	Background Ques. Pre-test				(AN/WSC-3 Lab) Problems 1 -3	(AN/WSC-3 Lab) Problems 4,5
0900	_____ Course Start				Subsection A	Subsection B
1000						
1100						C-School Critique
1200						
1300	Course (Continue)	Course (Continue)	Course Completion		Hands-on Tests (AN/WSC-3 Lab)	Hands-on Tests (AN/WSC-3 Lab)
1400			_____ Testing Intro. & Lab Familiarization		Problems 1 - 3 Subsection B	Problems 4,5 Subsection A
1500						
1600			_____ Post-test (1 hour)			
1700						C-School Critique

APPENDIX E

ANALYSIS OF CRITIQUES AND QUESTIONNAIRE

This appendix contains four tables:

Table E-1 This table presents the response frequencies for the CBT Duty Station Group (DS), to all Likert-type questions in their version of the C-School Critique. There were seventeen students in this group.

Table E-2 This table presents the response frequencies for the CBT Remote Group (RM), to all Likert-type questions in their version of the C-School Critique. There were sixteen students in this group.

Table E-3 This table presents the response frequencies for the Resident Group (RS), to all Likert-type questions in their version of the C-School Critique. There were thirteen students in this group.

Table E-4 This table presents the response frequencies of the duty station facilitators to all Likert-type questions in the Facilitator Questionnaire. Fourteen facilitators filled out the questionnaire and returned it to the R&DC Project Officer.

TABLE E-1. CBT DUTY STATION GROUP RESPONSES TO C-SCHOOL CRITIQUE

Questions	Question Response Categories (Frequency of Student Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I am very confident of my ability to maintain this equipment.	0	0	0	12	5
2. Testing clearly measured my ability to perform each objective.	0	0	2	12	3
3. Plenty of practice is provided for each objective.	0	1	10	6	0
4. Proper troubleshooting techniques are taught, and tested.	0	0	2	13	2
5. Troubleshooting problems are realistic.	0	0	0	14	3
6. Course is presented in a logical sequence.	0	0	4	12	0
7. Course length is ideal. **	0	0	4	12	0
8. Proper tools and test equipment are always available in the computer media.	1	1	1	12	2
9. Spare parts are available and ready for use in computer media.**	1	0	1	11	2
10. Safety equipment is always available. **	1	0	1	11	3
11. Training and visual aids enhanced learning.	0	0	1	11	5
12 Technical manuals are current, legible, and accessible.	0	0	1	11	5
13. HELP information on the computer was understandable and enhanced training.	0	0	0	12	5
14. Course work directly relates to course objectives.	0	0	0	15	2
15. Welcome aboard package is very helpful.	6	0	3	8	0
16. The facilitator clearly and concisely answered all questions.	0	1	7	7	2
17. Facilitator maintained control.	0	0	7	8	2
18. Facilitator is knowledgeable, skillful, and confident in assisting training process.	0	0	6	8	3
19. Facilitator strictly enforced safety standards.	3	0	4	7	3
20. Training environment was comfortable and functional.	1	2	2	9	3
21. There is good visibility in training room/spaces.	0	0	3	10	4
22. There were no distractions during training.	0	2	5	7	3
23. Training time was never wasted.	1	1	3	9	3
24. I was well prepared to take this AN/WSC-3 course.	1	1	2	12	1
25. The AN/WSC-3 course was directly relevant to my job.	1	0	1	13	2
26. The quality of training was satisfactory.	0	0	3	11	3
27. The course was effective overall. **	0	0	0	13	3
28. The AN/WSC-3 computer-based course was as effective as a traditional classroom/lab course.	0	1	9	5	2
29. The level of AN/WSC-3 instruction detail was sufficient. **	0	0	4	11	1
30. The AN/WSC-3 computer-based course was challenging.	0	0	4	13	0
31. The amount of general theory provided was sufficient.	0	1	3	11	2
32. The computer medium was satisfactory for the practice problems.	0	1	3	11	2
33. Some AN/WSC-3 equipment hands-on training should be provided after completing the computer-based part of the course.	0	0	2	5	10
34. The computer-based training materials were user friendly	1	0	1	6	9
35. The computer and software worked satisfactorily.	1	0	0	7	9
36. I had no difficulty learning to use the computer for this course.	0	0	0	5	12
37. The training environment (room, table/desk where trained on the computer) was satisfactory.	0	0	5	8	4
38. The time made available for me to do the course was adequate.	0	1	5	8	3
39. Computer-based training at duty stations can be effective in the Coast Guard.	1	0	1	8	7
40. My command strongly supported this AN/WSC-3 computer-based training.	2	0	1	8	6
41. I had no difficulty in setting up and conducting the computer-based training.	1	0	1	11	4
42. The computer-based training conducted at my duty station was convenient.	0	1	6	6	4
43. There was very little interference from others during my training sessions.	1	1	6	5	4
44. The computer and all necessary guidance and training materials were satisfactorily received at my duty station.	0	0	0	9	8

Note: ** Denotes one or two students failed to answer question

TABLE E-2. CBT REMOTE GROUP RESPONSES TO C-SCHOOL CRITIQUE

Questions	Question Response Categories (Frequency of Student Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I am very confident of my ability to maintain this equipment.	0	0	1	9	6
2. Testing clearly measured my ability to perform each objective.	0	0	2	13	1
3. Plenty of practice is provided for each objective.	0	0	5	11	0
4. Proper troubleshooting techniques are taught, and tested.	0	0	1	8	7
5. Troubleshooting problems are realistic.	0	0	0	10	6
6. Course is presented in a logical sequence.	0	0	0	8	8
7. Course length is ideal.	0	1	4	7	4
8. Proper tools and test equipment are always available in the computer media.	0	0	0	10	6
9. Spare parts are available and ready for use in computer media. **	0	0	1	8	6
10. Safety equipment is always available.	0	0	0	5	11
11. Training and visual aids enhanced learning.	0	0	0	8	8
12 Technical manuals are current, legible, and accessible.	0	0	1	8	7
13. HELP information on computer is understandable and enhances training.	0	0	0	9	7
14. Course work directly relates to course objectives.	0	0	0	11	5
15. Welcome aboard package is very helpful.	7	0	1	8	0
16. The facilitator clearly and concisely answered all questions.	0	0	3	7	6
17. Facilitator maintained control.	0	0	0	5	11
18. Facilitator is knowledgeable, skillful, and confident in assisting training process.	2	0	1	6	7
19. Facilitator strictly enforced safety standards.	2	0	0	7	7
20. Training environment was comfortable and functional.	0	0	0	10	6
21. There is good visibility in training room/spaces.	0	0	0	9	7
22. There were no distractions during training.	0	0	0	9	7
23. Training time was never wasted.	0	0	4	7	5
24. I was well prepared to take this AN/WSC-3 course.	0	0	3	11	2
25. The AN/WSC-3 course was directly relevant to my job.	0	0	0	12	4
26. The quality of training was satisfactory.	0	0	0	10	6
27. The course was effective overall.	0	0	0	10	6
28. The AN/WSC-3 computer-based course was as effective as a traditional classroom/lab course.	0	1	0	10	5
29. The level of AN/WSC-3 instruction detail was sufficient. **	0	0	3	11	1
30. The AN/WSC-3 computer-based course was challenging.	0	0	3	11	2
31. The amount of general theory provided was sufficient.	1	0	2	10	3
32. The computer medium was satisfactory for the practice problems.	0	0	2	11	3
33. Some AN/WSC-3 equipment hands-on training should be provided after completing the computer-based part of the course.	0	0	2	2	12
34. The computer-based training materials were user friendly and easy to use.	0	0	0	7	9
35. The computer and software worked satisfactorily.	0	0	0	8	8
36. I had no difficulty learning to use the computer for this course.	0	0	0	8	8
37. The training environment (room, table/desk where trained on the computer) was satisfactory.	0	0	0	8	8
38. The time made available for me to do the course was adequate.	0	0	0	10	6
39. Computer-based training at duty stations can be effective in the Coast Guard.	0	0	3	8	5

Note: ** Denotes one or two students failed to answer question

TABLE E-3. RESIDENT GROUP RESPONSES TO C-SCHOOL CRITIQUE

Questions	Question Response Categories (Frequency of Student Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I am very confident of my ability to maintain this equipment.	0	0	0	10	3
2. Testing clearly measured my ability to perform each objective.	0	0	0	11	2
3. Plenty of practice is provided for each objective. **	0	0	1	9	2
4. Proper troubleshooting techniques are taught, and tested. **	0	0	0	9	3
5. Troubleshooting problems are realistic.	0	0	0	9	4
6. Course is presented in a logical sequence.	0	0	0	11	2
7. Course length is ideal.	0	0	0	13	0
8. Proper tools and calibrated test equipment are always available.	0	0	0	7	6
9. Spare parts are plentiful and ready for issue.	0	0	0	7	6
10. Safety equipment is always available.	0	0	0	8	5
11. Training and visual aids enhanced learning.	0	0	2	8	3
12 Technical manuals are current, legible, and accessible.	0	0	0	9	4
13. Handouts are legible and enhance training.	0	0	0	10	3
14. Course work directly relates to course objectives.	0	0	0	9	4
15. Welcome aboard package is very helpful.	7	1	1	4	0
16. The instructor clearly and concisely answered all questions.	0	0	0	9	4
17. Instructor maintained interest and control of class.	0	0	0	9	4
18. Instructor is knowledgeable, skillful, and confident.	0	0	0	7	6
19. Instructor strictly enforced safety standards.	1	0	0	6	6
20. Classroom and labs are comfortable, and functional. **	0	0	0	7	5
21. There is good visibility in classroom and lab.	0	0	0	8	5
22. There are no distractions to the class.	0	2	0	7	4
23. Class time is never wasted. **	0	1	0	8	3
24. I was well prepared to take this AN/WSC-3 course. **	1	0	0	9	2
25. The AN/WSC-3 course was directly relevant to my job. **	0	0	1	10	1
26. The quality of training was satisfactory.	0	0	0	9	4
27. The course was effective overall.	0	0	0	10	3
28. The level of AN/WSC-3 instruction detail was sufficient.	0	0	1	10	2
29. The amount of general theory provided was sufficient.	0	0	1	10	2

Note: ** Denotes one or two students failed to answer question

TABLE E-4. FACILITATOR RESPONSES TO FACILITATOR QUESTIONNAIRE

Questions	Question Response Categories (Frequency of Facilitator Responses)				
	N/A	Strongly Disagree	Disagree	Agree	Strongly Agree
1. The duty station command strongly supported this training.	0	0	1	8	5
2. The computer, headphones, and guidance and training materials were satisfactorily received at my duty station.	0	0	0	5	9
3. All materials and information needed to complete the training were provided.	0	0	0	5	9
4. The guidance information for facilitating the computer-based training was satisfactory.	0	0	0	9	5
5. The training facilitation task was performed without difficulty.	0	0	2	8	4
6. Scheduling of training sessions was not a problem.	0	1	1	8	4
7. Finding appropriate space for the student to use during training was not a problem.	0	0	1	7	6
8. The student's training sessions ran smoothly.	0	0	1	7	6
9. There was little interference from others during the training sessions.	0	0	2	6	6
10. Interaction with the Student was satisfactory.	0	0	0	8	6
11. The self-paced method of this course was convenient.	0	0	1	6	7
12 Overall quality of the computer-based media was satisfactory.	0	0	0	6	8
13. The computer and software worked satisfactorily.	0	0	0	4	10
14. Computer-based training courses, similar to this one, can be effective at duty stations.	0	0	1	4	9
15. Student travel arrangements were handled satisfactorily.	1	0	0	6	7